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A JOURNAL DEVOTED TO THE INTERESTS, PRACTICE, AND PROGRESS OF AERIAL LOCOMOTION AND TRANSPORT

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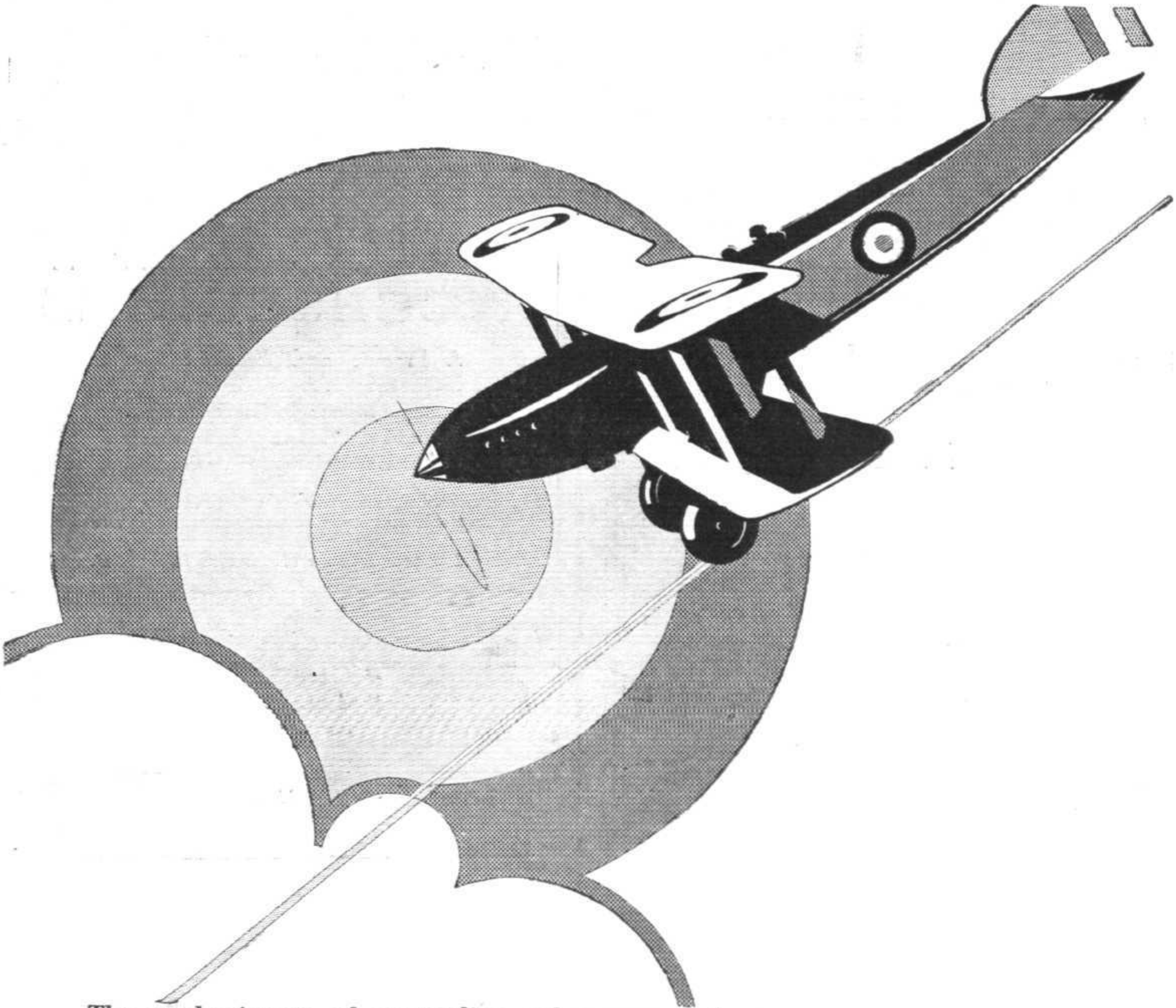

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The AIRCRAFT ENGINEER & AIRSHIPS

First Aeronautical Weekly in the World. Founded January, 1909

Founder and Editor : STANLEY SPOONER

A Journal devoted to the Interests, Practice, and Progress of Aerial Locomotion and Transport

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1929.

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May 9	**Lecture, "Civil Aviation Prospects in East Africa," by F. Symms, before R.Ae.S. and Inst.Ae.E.**
May 20	**Northampton Air Pageant.**
May 23	**Lecture, "Lubrication of Aircraft Engines," by F. A. Foord, before R.Ae.S. and Inst.Ae.E.**
June 19-22	**F.I.A. Conference, Copenhagen.**
June 27-30	**Rotterdam International Air Meeting.**
July 5-6	**King's Cup Race.**
July 13	**R.A.F. Display at Hendon.**
July 16-27	**7th International Aero Exhibition, Olympia.**
July 25	**Bleriot Cross-Channel Flight Anniversary Fete, Calais.**
July 28	**International Flying Meeting, Sweden.**
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Sept. 10-20	**Aero Club de France Meeting, Le Baule.**

EDITORIAL COMMENT

IT may be said that the flight, on Monday last, of the Lord Mayor of Manchester, accompanied by members of the City Council, from the Manchester aerodrome to Croydon, for the purpose of obtaining direct from the hand of the Secretary of State for Air, Sir Samuel Hoare, the licence for the newly-established municipal aerodrome of Manchester, was made "at the psychological moment" inasmuch as it marked two important events : the establishment of the first British municipal aerodrome, and the first official flight in connection with the newly-formed company, "Northern Air Lines, Limited." The occasion was "psychological" because it occurred at the very moment when National Flying Services, Limited, were inviting the public to subscribe to the company to which the Air Ministry has promised a subsidy in the form of a capitation grant of £10 for each pilot turned out. The new company, Northern Air Lines, is starting without any subsidy whatever, simply as an ordinary business venture, believing that aviation within the British Isles can be made to pay its way unaided. And Manchester is evidently fairly solidly and energetically behind the effort. That Manchester should be the first city in the kingdom to establish a municipal aerodrome is not in the least surprising. The meetings organised by the Lancashire Aero Club, and held at Woodford aerodrome, have indicated the very great interest which Manchester takes in aviation, and the City Fathers have now given that interest and enthusiasm concrete expression by establishing their new Air Port of Manchester. At first the aerodrome will be at Wythenshaw, but later a move will be made to Chat Moss aerodrome. The determination of Manchester to be in the front rank is typically Lancastrian, and it is to be hoped that their very excellent example will soon be followed by other cities in the kingdom.

"What Lancashire Thinks today . . ."

Northern Air Lines have already engaged a fleet of aircraft for hire to customers who desire to be flown to any part of the country. At the moment the fleet is of a somewhat heterogeneous character, it is true, including "Moths," D.H.9's and Avro 504's,

but doubtless as soon as the necessary arrangements can be completed, other types will be acquired, more up to date than the last two types mentioned, and suitable for "feeder line" work. Types that come to mind in this connection are the De Havilland "Hawk Moth" and the new Desoutter monoplane, each of which should be ideal for relatively short flights with one, two or three passengers as the case might be, and the hire of which should be very reasonable. With the fleet already available, Northern Air Lines have based their estimates on 1*s*. 3*d*. per mile, a figure which might be reduced by the use of modern types of machines. We gather that already the new company has made arrangements with several local concerns and interests for the conveyance of passengers to different parts of the country, and everyone will wish Northern Air Lines all the success which their determined effort entitles them to.

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No Type Barred

It is now several months ago that we referred in these columns to a most interesting and promising experimental air service linking France with South America. Using aircraft over the two terminal stages and surface vessels over the middle portion, this service operated experimentally last year, and may now be said to have reached a stage of development where it is a practical proposition. Thus on April 22 mails arrived at Croydon aerodrome which had left Buenos Aires on April 13. Leaving Buenos Aires by aeroplane, a landing was made on the island of Fernando Noronha, where a fast surface vessel took the mails on board and carried them to Cape Verde, where the mails were again transhipped to a seaplane, which took them to St. Louis. There an aeroplane took them over and conveyed them to Toulouse, where they were transferred to the night train, which carried them to Paris. Those bound for addresses in Great Britain were conveyed to Le Bourget and flown to Croydon by one of the Air Union's aeroplanes.

Two features mark this flight as one of exceptional interest: The speed with which the mails were conveyed, and the intelligent use made of various means of locomotion. To us in this country there is a lesson to be learned from this French example. France was as interested in a South Atlantic service as we are in a North Atlantic one. But France has not waited until she had airships capable of spanning the sea distance of the route. Instead she made use of surface vessels over such stages as were as yet beyond the practical scope of heavier-than-air craft. In pointing this out, we do not suggest that Great Britain should abandon her airship programme, but merely that we might learn from France that possibilities do exist apart from airships. The air route to Australia, beyond Karachi, might offer opportunities of a similar character for combining sea and air in the carriage of mails. And in Africa it is at least conceivable that, until the whole route from Cairo to South Africa is in working order, a considerable speeding-up could be effected by working, at the beginning, certain stages by aircraft, leaving other stages to be operated by existing railways. At least the possibilities should not be overlooked.

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A Very Fine Flight

In view of the fact that the "feeder line" type of aircraft is just beginning to show signs of being extensively developed in this country, considerable interest attaches to the flight recently completed by a French machine of this general class. Leaving France on March 26 in the little Farman F.190 monoplane with Gnome-Rhone "Titan" engine, Bailly and Reginensi reached Saigon on April 5, having flown *via* Belgrade, Constantinople, Aleppo, Basra, Karachi, Calcutta and Bangkok. After a stay of a week, the two French aviators arrived at Le Bourget on April 20, having covered some 7,500 miles in just over eight days. This represents a performance of which not only the aviators, but the Farman and Gnome-Rhone companies may justly be proud.

The outstanding feature of the Farman F.190 is, as we have previously pointed out, its remarkable ratio of disposable load to tare weight. The former is 1,870 lb. and the latter 1,650 lb., so that the machine carries, as a normal load, more than its own weight in disposable load. It may be assumed, of course, that most of the difference between the permissible load and the actual weight of the crew was made up of fuel so as to enable the machine to cover long stages non-stop, but this scarcely affects the argument. In its standard form the F.190 carries pilot and four passengers and fuel for a flight of about 500 miles. This, on an engine rated at 230 h.p., is distinctly good, and appears to indicate that the "feeder line" class of machine can be a very useful type indeed. Doubts have been expressed whether the F.190 would get a British C. of A. Quite possibly it could not. But the flight to Indo-China and back seems to show that there is nothing much the matter with the machine from the airworthiness point of view.

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New Zealand's Air Defence

The New Zealand Prime Minister, Sir Joseph Ward, has said that the Government recognised the necessity of making preparations for air defence greater than those made hitherto, but *it could not maintain at full strength two* independent systems of land and air defence. The change must be a gradual process, and would involve the combination of the present land forces and the new air forces. Government would probably require to submit to Parliament proposals to effect the change of system necessitated by the marvellous development of air defence methods.

Mails from the Argentine in Eight Days

After travelling 8,250 miles by aeroplane, seaplane, steamer and night train in eight and a half days, mails from Buenos Aires arrived at Croydon aerodrome on an Air Union liner on April 22. The mails left Buenos Aires on April 13 on the new French air mail service. They were taken by 'plane to the island, Fernando Noronha, then put on board a fast mail packet steamer running especially for this service across the Atlantic to Cape Verde Island. There they were transferred to a seaplane and flown to St. Louis, Senegal, whence they were taken by aeroplane, *via* Morocco and Spain, to Toulouse. The night express took the mails to Paris. The fastest mail steamers take 18 days for the journey from Buenos Aires to London.

French Air Force Changes

Changes are to be made in the organisation of the French Air Force. While military and naval air squadrons will be under the command of the military and naval authorities respectively, the Air Ministry will command only a reserve force consisting probably of two regiments of fighting 'planes. This change does not affect in any way the strength of the French Air Force.

MANCHESTER'S MUNICIPAL AERODROME

Lord Mayor's Flight to Croydon

"IT is an old saying that 'what Manchester thinks today, the rest of England thinks tomorrow.' Today Manchester is talking aerodromes, and tomorrow the other municipalities of England will sit up and take notice." So said Councillor William Davy, Deputy Lord Mayor of Manchester, and Chairman of the Aerodrome Committee, when, on April 22, the Air Minister, Sir Samuel Hoare, had handed to the Lord Mayor (Col. George Westcott) the licence for the temporary aerodrome at Wythenshaw.

Manchester has indeed taken the lead in a notable manner in being the first city of England to establish a municipal aerodrome. Chat Moss is the chosen site, but considerable work must be done on it, and the city is spending £45,000 on that work. In the meantime a temporary aerodrome at Wythenshaw is being used, and on April 22 the Lord Mayor of Manchester, accompanied by Councillor Davy, Alderman R. A. W. Carter (Deputy Chairman of the Aerodrome Committee), Mr. Warbeck Howell (Town Clerk), and Mr. S. Hill, of the Town Clerk's Department, came from Manchester to London to receive the licence from the hands of the Air Minister.

The Lord Mayor and his party did not confine their interest in civil flying merely to coming to London, though that step in itself was a striking one. They came by aeroplane. Two machines—a red D.H.50 and a bright blue D.H.9C, both with "Puma" engines—were chartered from Northern Air Lines, Ltd., and Mr. John Leeming, chairman of the company, flew down himself in company with the Lord Mayor. The pilots were Capt. Kingwill and Mr. E. A. Jones. The Lord Mayor travelled in correct black coat and silk hat, as he was officially visiting a Minister, and by doing so demonstrated that air travel is not a knockabout adventure.

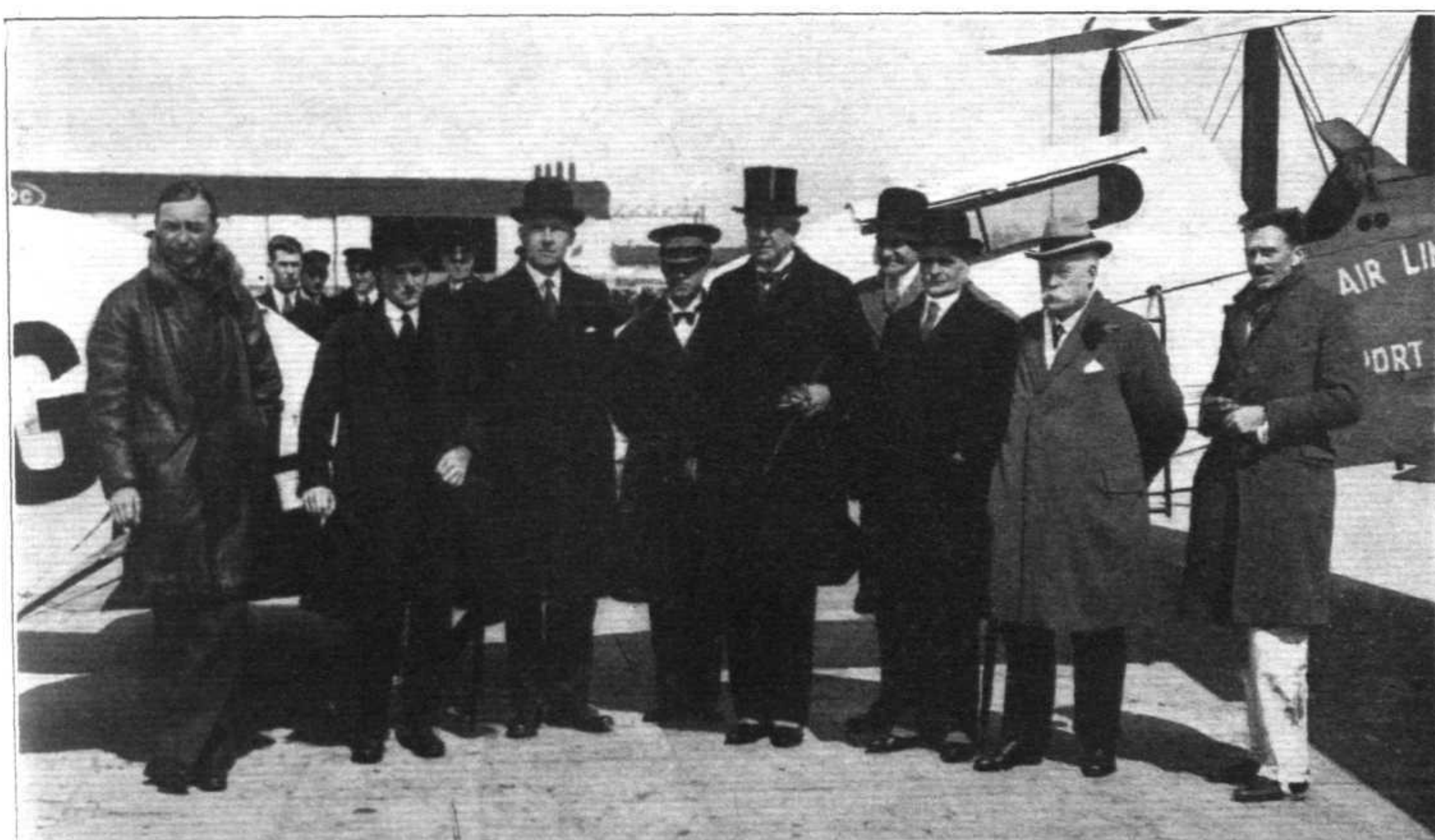
The two machines arrived in company over Croydon just before 1 p.m., and the Lord Mayor, on de-planing, said that he had enjoyed the flight. He mentioned that they had had refreshments served in the D.H.50. But he was obviously more interested in the occasion than in the actual flight, albeit it was the first municipal journey of its kind. He mentioned with gratification that Mr. H. W. Lee, the President, and some members of the Manchester Chamber of Commerce had come to Wythenshaw to see them off.

Mr. Bertram, Deputy Director of Civil Aviation, met the party at Croydon, and after they had had lunch at the aerodrome hotel, he conducted them by car to Gwydyr House and introduced them to Sir Samuel Hoare.

The Air Minister, addressing Col Westcott, said that his first memory of a Lord Mayor was on a Lord Mayor's procession in London, and he had since been inclined to think of a Lord Mayor as a very old gentleman with a long white beard, travelling about in a gold coach with a fat coachman in a curly wig. How different was the present picture: the Lord Mayor of Manchester with his Town Clerk making a progress, not in a gold coach, but in an aeroplane. Sir Samuel said he had travelled 40,000 to 50,000 miles by air, and his chief impression was that the use of the aeroplane could not be exaggerated as an instrument by which business men could go quickly to meet each other. Personal conversation was always better than correspondence. He congratulated the Lord Mayor and all the citizens of Manchester. Not only was this the first flight of the kind, but Manchester was the first corporation to provide a municipal aerodrome for public use.

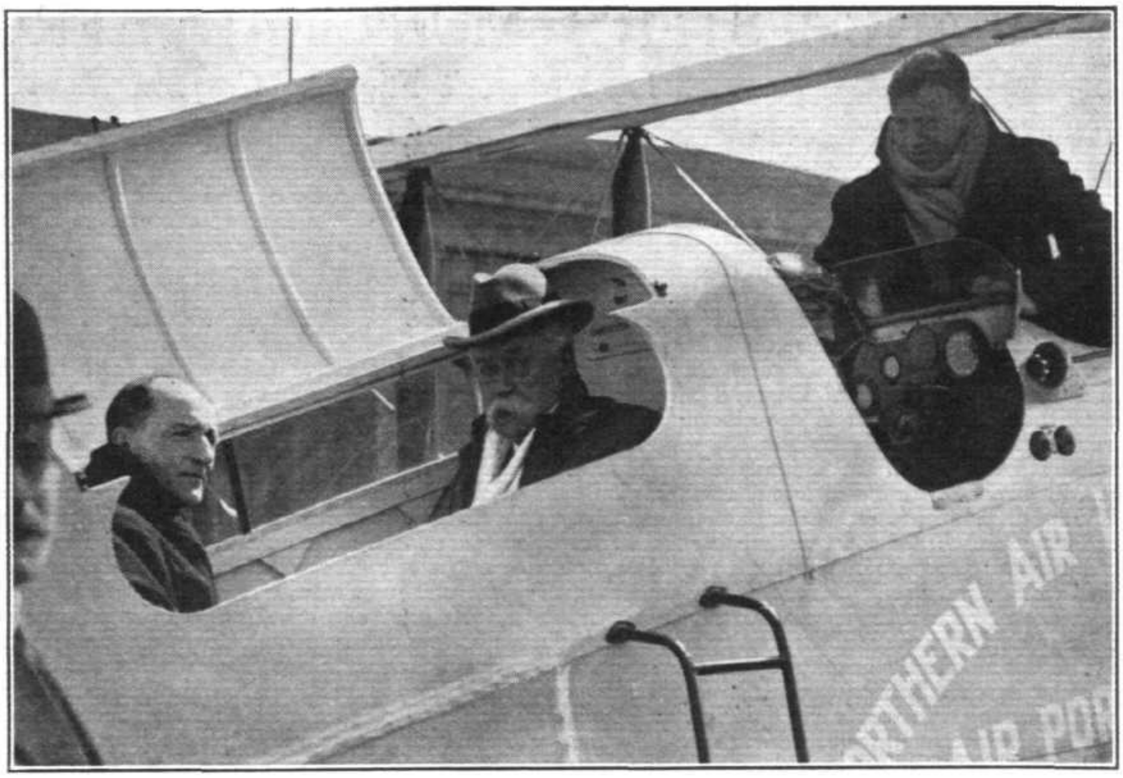
Sir Samuel Hoare then handed the licence to the Lord Mayor, who said in his reply that a few years ago Manchester was an inland town. The Ship Canal had made it the second or third port in the country. It was now also an air port and it was not going to be the second or third air port, but the first. Councillor Davy and Alderman Carter also replied.

The party flew back to Manchester in the evening, and on the way one of the machines had to land for about a quarter of an hour near Newcastle-under-Lyme to refill the radiator. A crowd was waiting at Wythenshaw, where two Avros had been taking people up for flights during the day, and as he de-planed, the Lord Mayor waved the licence over his head for all to see.



["FLIGHT" *Photograph*

Arrival of Manchester's Civic Officials at Croydon on April 22 to receive the licence for Manchester's Aerodrome from Sir Samuel Hoare. The party flew down in the Northern Air Lines, Ltd., D.H. machines. Left to right:—Capt. A. N. Kingwill, Chief Pilot to the Company; Mr. Hill (Town Clerk's Dept.); Mr. Warbeck Howell (Town Clerk); Col. George Westcott (Lord Mayor of Manchester); Mr. John F. Leeming, a Director of Northern Air Lines, Ltd.; Councillor W. Davy; Alderman R. A. W. Carter and Capt. E. A. Jones (pilot).



Showing how Manchester arrived in London: Mr. Hill (left) and Alderman R. A. W. Carter in the cabin of the D.H.9c (Puma) after it reached Croydon. The pilot is Capt. A. N. Kingwill, and above him in the front cockpit is the Town Clerk, Mr. Warbeck Howell.

["FLIGHT" *Photograph*

Northern Air Lines, Ltd., which provided the air transport for the party, is a young but very energetic company, as one would expect of a body which has Mr. Leeming for its moving spirit. The municipal flight was intended as the formal opening of the firm's activities, but on the day before a Mr. Wishton, who is in the artificial silk business, insisted that he must get in a hurry from Manchester to Northwich, in Cheshire, so the firm sent him down there in a Moth, charging 1*s*. 3*d*. a mile. Already the firm has secured a contract with a textile company for a weekly flight from Manchester to Cardiff, then to Sheffield and back to Manchester; and other contracts are in prospect. Mr. Leeming said that his chief difficulty was to get hold of enough machines and pilots. His chief pilot is Capt. Kingwill, who was lately in charge of the flying school at Renfrew; and two others, Messrs. Lawson and Heaton, have been engaged. The fleet at present consists of three D.H. cabin machines with "Puma" engines, two Moths, and eight 504 K Avros. The acquisition of two Avro monoplanes with three "Lynx" engines (built under Fokker licence) is being considered. In short, Northern Air Lines, Ltd., is very much alive, and its prospects appear to be quite rosy.

F. A. de V. R.

FLYING VISITORS OF INSPECTION: **On the occasion of the demonstration of the new "Cirrus-Hermes" engine at Croydon last week, several light 'planes were flown to Croydon so that their owners could inspect it. Our picture shows a Blackburn "Bluebird" (top) piloted by G. E. Lowdell (Suffolk Aeroplane Club) and the Westland "Limousine" (3 "Cirrus III"), piloted by Capt. Paget, which machine will shortly be fitted with "Cirrus Hermes" engines.**

A NEW AIR-COOLED "IN-LINE" AERO ENGINE

The CIRRUS HERMES

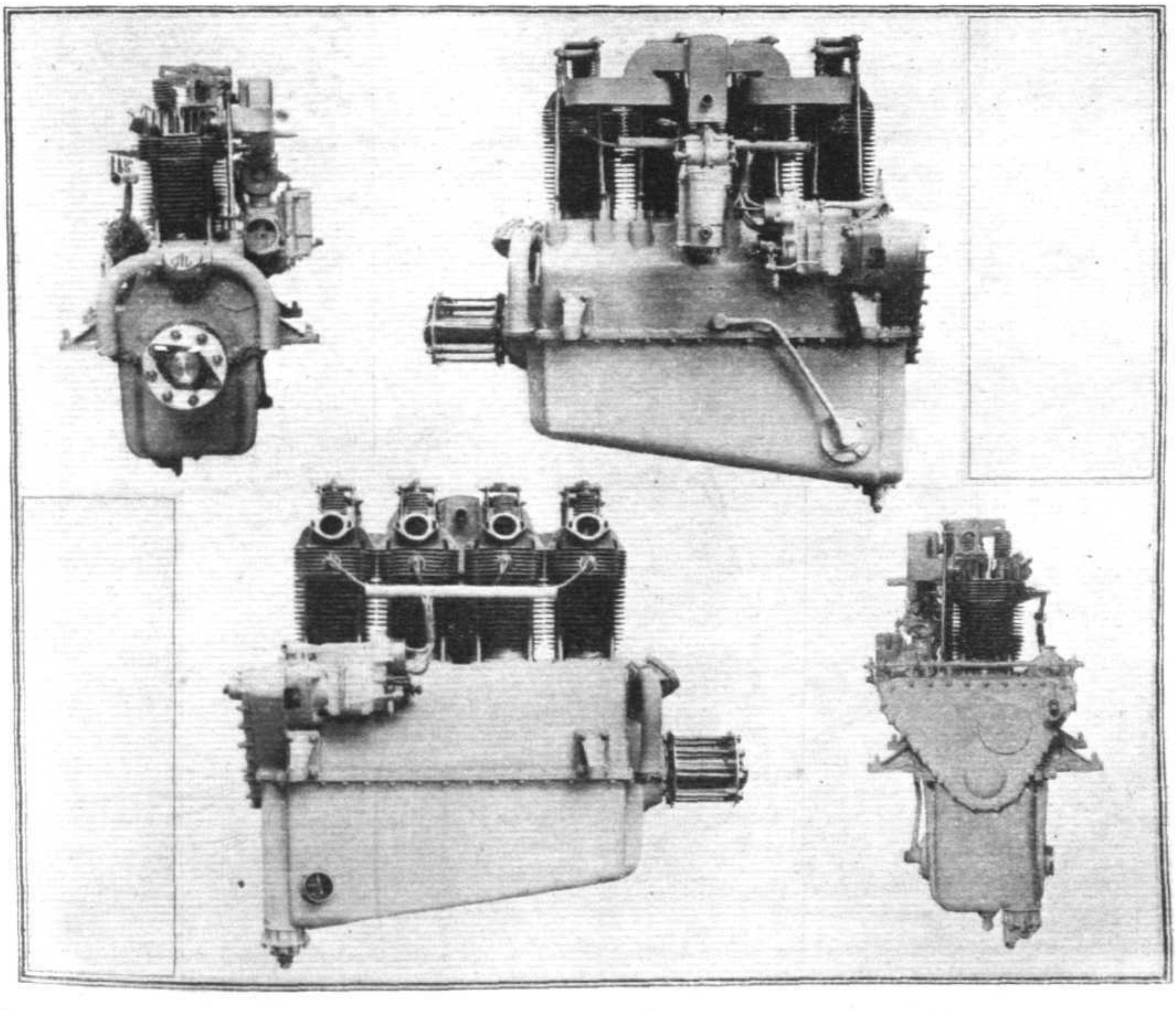
"A LITTLE More and How Much it is; a Little Less and what Worlds Away." So it is, it would seem, with aircraft and their power units—a machine is produced and makes good, but in a little while its owner desires that "little more." When A.D.C. Aircraft, Ltd. first produced the "Cirrus" engine, which has been installed with such success in so many British light 'planes, it was rated at 27-60 h.p., and accomplished much useful work in connection with the Light 'Plane Clubs. Then the "Cirrus Mark II" came along with a few extra horses and some more successes; this was followed by the "Mark III" which now gave 85-95 h.p., with but 55 lbs. more weight than the "Mark I."

With these "Cirrus" engines, as our readers know, many notable flights were accomplished, such as the Stack and Leete London-India (1927); Bentley's London-Cape Town-London (1927-8); Bert Hinkler's England-Australia; and Capt. Lancaster's England-Australia with Mrs. Miller as passenger; Lady Heath's South Africa-England; and Lady Bailey's 18,000 round Africa (1928).

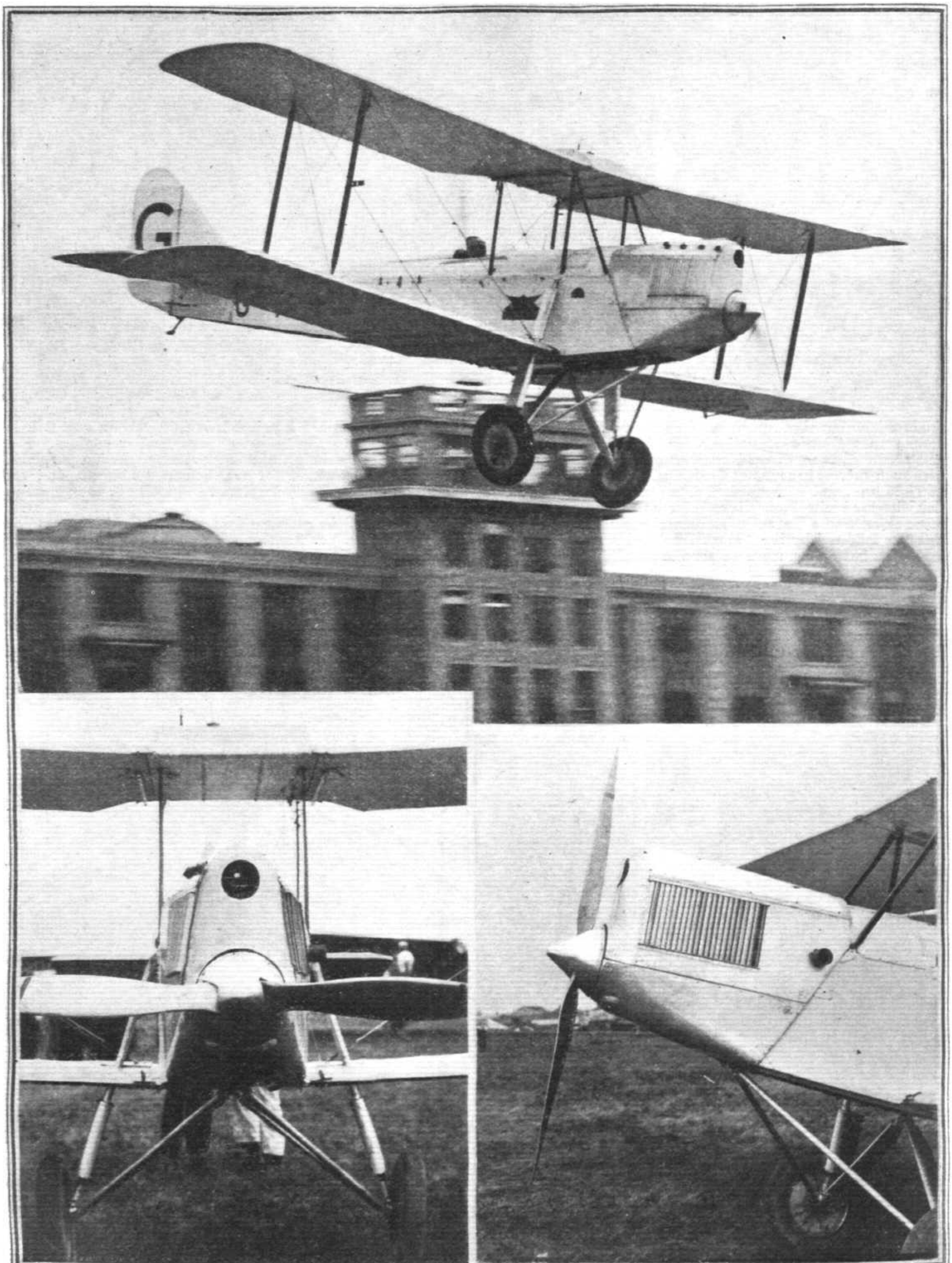
And now, in order to meet the demand for an engine for special purposes, of higher power than the "Cirrus Mark II" or III," Cirrus Aero Engines, Ltd. (a subsidiary company of A.D.C. Aircraft formed to handle "Cirrus" aero engines), have produced a new aero engine of a similar type, *i.e.*, a four-cylinder in-line air-cooled engine. The "Cirrus Hermes," as it is called, it should be noted, is, however, an entirely new engine, differing in many respects from the other "Cirrus" engines, as will be apparent even on inspecting the accompanying external views of the "Hermes."

This new engine is the result of many months' work on the part of the company's designing staff, and incorporates the results of the experience acquired in the production and subsequent performance of hundreds of "Cirrus" engines. Whilst it may be considered in a way as an addition to the "Cirrus" family, it should be pointed out that its higher horse-power—it is rated at 105-115 h.p.—puts it to a certain extent in a different class to the "Cirrus" and similar engines. For instance, it is specially suitable for service training purposes, for small flying-boats, for multi-engined aircraft, and for light 'planes—especially seaplanes—which have to operate in hot climates, etc.

Nevertheless, the power-weight ratio of the "Hermes" is less than 3 lbs. per h.p., as compared with 3½ lbs. in the case of the "Cirrus"—the total weight being only 5 lbs.



THE "CIRRUS HERMES" AERO ENGINE: Four views of the new 4-cyl. in-line air-cooled engine, which is rated at 105-115 h.p.



["Flight" Photographs

THE "CIRRUS HERMES" AERO ENGINE: An Avro "Avian," fitted with the new "Hermes" engine, and piloted by Capt. Neville Stack, touches some 125 m.p.h. at Croydon Aerodrome. Below are two views showing the neat installation and cowling of the "Hermes" in the "Avian."

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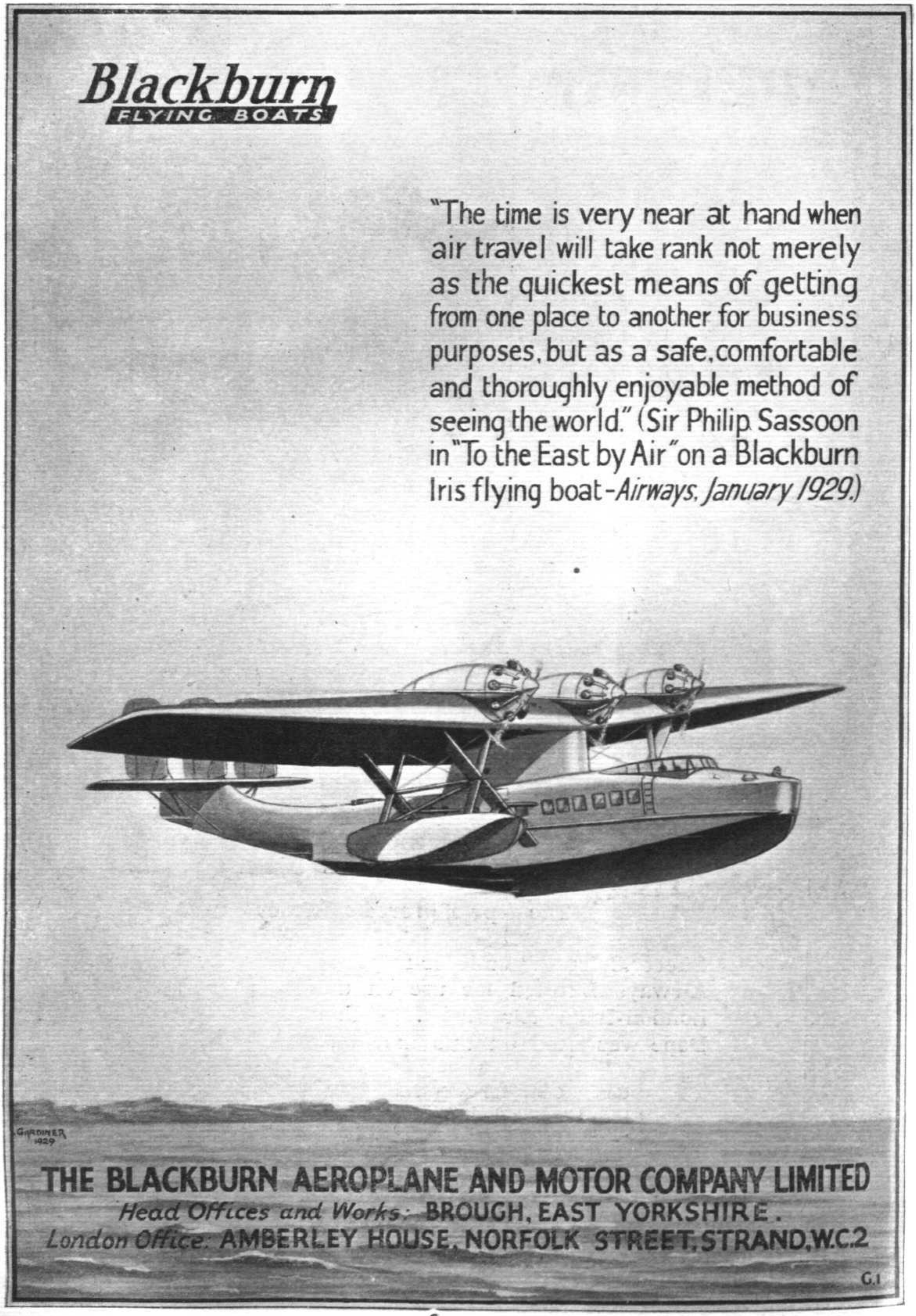
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more than that of the "Cirrus Mark III." Also, the "Hermes" can be installed on the same engine bearers that take the "Cirrus," the "Hermes" having the same overall height as the "Cirrus," although the overall length is 7 in. less, and, we believe, the width is also slightly less. Incidentally, the reduced length should enable aircraft designers to provide a vertical fire-proof bulkhead in their machine, as well as saving space to allow for extra fuel or accommodation.

We do not propose this week to give a detailed description of the "Cirrus Hermes" engine—we reserve that for a future occasion—but only wish to introduce this new engine to our readers with a few remarks on its outstanding features and our impressions of an inspection of the "Hermes," in the making, completed, and in the air, at the Cirrus Company's Works at Croydon.

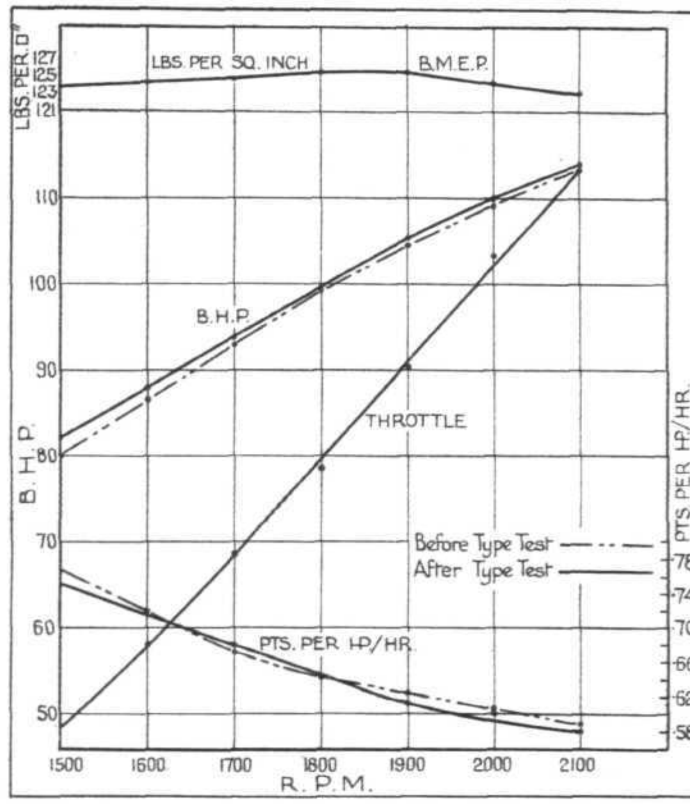
Let us now run over the points of interest regarding the "Hermes." Steel connecting rods, machined all over and carefully balanced, are fitted instead of ones made of Y-alloy, while the crankshaft has been specially designed and is carried on five substantial plain bearings. Lubrication is forced feed throughout, all the main supply oil pipes, except one, being fitted inside the crankcase; the oil system is of the wet sump type, so designed that the oil is only used as required, so that the temperature of the oil is much lower, whilst its viscosity is also retained over a longer period. With this system the oil gauge is a definite indicator of the satisfactory working of the oil supply, the pressure on the gauge being constant at all speeds and under all conditions of temperature. The sump holds three gallons of oil. An oil tray is fitted to trap the oil supply in the sump during the performance of aerobatics.

Micrometer adjustment is provided for the valve tappets, and this is carried out in a very simple manner. The rocker gear is designed to carry a reserve supply of lubricant sufficient to last over an extended period of flight (over 50 hours).

The magnetos are both compactly mounted on the forward side of the timing gear casing at the rear of the engine, with the result that the contact breakers and distributors are very accessible for examination and adjustment when necessary; the high tension leads are of the minimum length. Each magneto is driven through the medium of a Simms Vernier coupling and Impulse starter, so that the engine can be started very easily on either magneto.

All the auxiliary gear is located at the rear of the crankcase and remains *in situ* when the cover is removed. The carburettor is mounted centrally on the left-hand side and the induction pipes lie snugly alongside the cylinders.

So much for constructional features. As regards our inspection of the actual engine, which we made last week when the Cirrus Company held an "At Home" at Croydon for this purpose, we were very favourably impressed. We first saw the "Hermes" in process of manufacture, and were able to observe the excellent workmanship that is put into this job. Then we saw a completed engine on the bench, and the clean lines and business-like appearance of the engine were at once apparent.



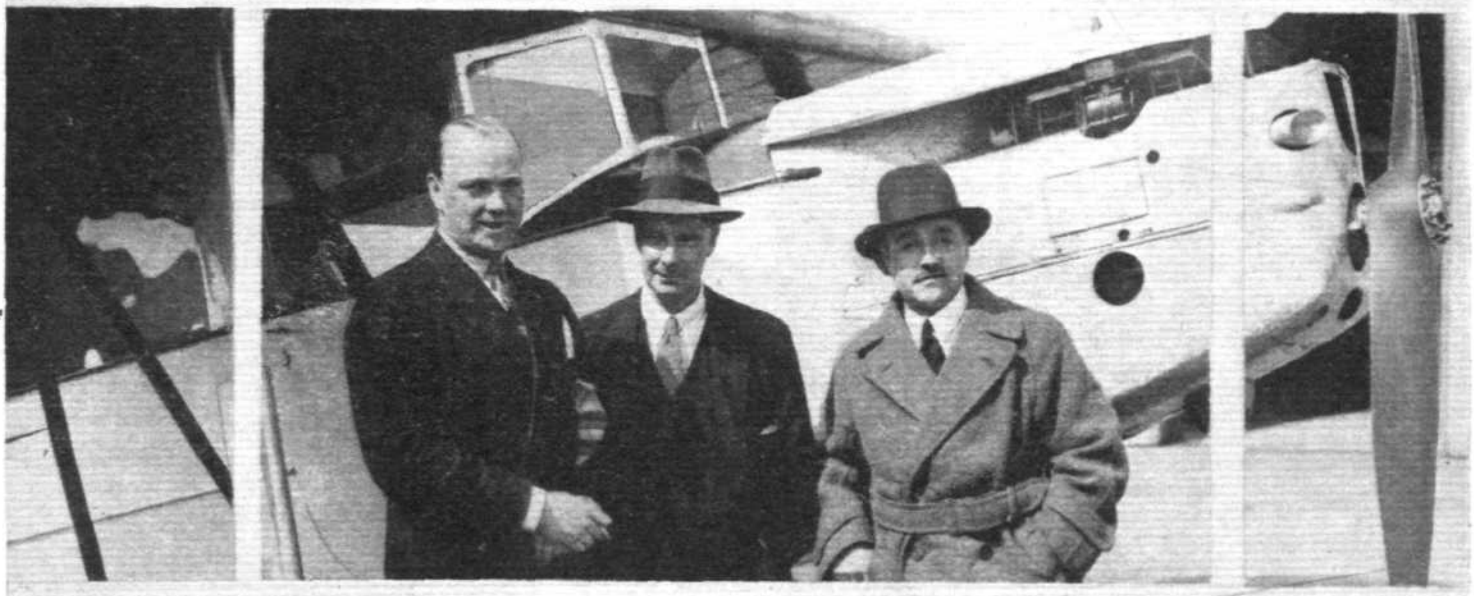
Type Test Power Curves of the "Cirrus Hermes" engine. Fuel—Shell Aviation Spirit. Oil—Vacuum B.B.

After this we went out on to the aerodrome, where Capt. N. Stack gave us a convincing demonstration of the "Hermes" under actual flying conditions. It was installed in an Avro "Avian"—and very neatly installed, too, as our illustrations show—and a microscope was *not* needed to observe the "Avian's" increased performance. Its climb was remarkable, and the speed at ground level was about 125 m.p.h.

Following the precedent created by the "Cirrus I, II, III" engines, the "Hermes" successfully passed the Air Ministry type test at the first attempt. A limited number of "Hermes" engines are being produced this month, and some have already been supplied to British aircraft manufacturers. It will not, however, be put into production until the first week in May, from which date it is expected the output will be 10 engines a week.

THE "CIRRUS HERMES" AERO ENGINE: **Some of those concerned in its production. From left to right—Maj. J. Stewart; Col. M. O. Darby; Capt. Neville Stack (test pilot); Mr. Olney (Works Manager); Mr. J. Walker (Works Superintendent); and Mr. Capel, the designer of the engine.**

THE NEW DESOUTTER-CIRRUS MONOPLANE



["Flight" Photographs

IT is with quite unusual satisfaction that we welcome back into the aviation world one of the most popular pilots of the old Hendon days, Mr. Marcel Desoutter. "Des," as everyone affectionately called him, was famous in those days as a pilot of the Bleriot monoplane, and it was on one of those machines that he had the accident (through the control stick slipping out of his hand while flying low) which deprived him of one of his legs. Actually the accident proved not altogether an evil, for as a result of it "Des" set to work to make himself an artificial leg, and before long he had evolved one which helped not only himself but many others to overcome their disability. In a few years Desoutter had established a famous business producing what is probably the finest artificial leg in the world. After many years Desoutter has "returned to the fold," this time as an aircraft constructor. As a starting point for the Desoutter Aircraft Company, "Des" has chosen the Koolhoven F.K.41 monoplane which was first seen in public at the Rotterdam light 'plane meeting last year. The original machine had a Siemens engine, but the British version will be fitted with a "Cirrus." The first "Cirrus"-engined monoplane was flown over from Rotterdam this week by Capt. Stack, and is illustrated in the photographs above. It will be seen that some slight changes, apart from those relating to the power plant, have been made in the strut bracing of the wing. One of the photographs shows Capt. Stack, Mr. Handsyde (who is works manager), and Mr. Desoutter.

The machine, which will be known as the Desoutter monoplane, Mr. Desoutter having acquired the sole British rights for its manufacture in this country, is a three-seater of the *conduite interieure* type, and is reported to be a very comfortable machine to fly in. The engine cowling shown will, we understand, be altered.

All his friends among the older readers of FLIGHT will join us in wishing "Des" every possible success in his venture.

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U.S. CIVIL AIR CHIEF ON DEVELOPMENTS IN COMMERCIAL AVIATION

Stunt Element Passing out of Flying—The Policy of No Subsidies

By H. J. J. SARGINT

"CIVIL flying is no longer a circus. The stunt element is passing out." So said Maj. Clarence M. Young, Chief of the Bureau of Aeronautics of the United States Department of Commerce.

Maj. Young, a veteran of the Great War, in which he valiantly served as an officer of the American Air Force and flew for nearly a year on the Italian front, has returned from an official tour of the continent of Europe, in the course of which he flew single-handed, for over 2,000 miles in a Stearman biplane fitted with a Wright "Whirlwind" engine. He visited France, Italy, Germany and Belgium for the purpose of examining air transport conditions in those countries and he also studied questions of civil aviation in Great Britain.

"I have spent six weeks in Europe," he said.

"How do the English airlines and aerodromes compare with those of the United States?" I asked him.

"Croydon is a very good aerodrome," he replied, "and the things that impressed me most about it were the administration buildings and facilities for controlling the aerodrome and the excellent accommodation afforded to passengers as well as to shippers and importers of merchandise. As to the operation of the airline itself, the impressive thing is the constant communication which the aerodrome has with the various aircraft *en route*."

"How does Croydon compare with the big aerodromes of the United States?" I asked.

"Well," said Maj. Young, "there is, of course, this difference. Practically all the aerodromes of the United States are established and constructed as the result of either municipal or private enterprise, which means that there are no State funds of any consequence available. There is also this additional consideration, that apart from a comparatively few locations, serious attention in the United States has not been given to comprehensive aerodromes, though more has been done in the last three years.

"We have, in the United States, about a thousand established aerodromes in various stages of completion. I mean by that that all those aerodromes, as far as area is concerned, and landing and taking off facilities are entirely satisfactory and available. Practically all of them are equipped to some extent with hangars and shop facilities and the like. I suppose that in practically all those thousand or so of aerodromes improvements are continuing as to additional buildings, lay-out plans, &c. I have in mind one or two in particular, but as there is pretty strong feeling about this question in some of the cities, I think I had better not mention any of them."

"So you would class Croydon as a first-class station?"

"Yes, I would surely call it an aerodrome of the first class, particularly in view of the improvements which are being made there, like the increase of the landing area. The building and equipment at Croydon I consider to be of outstanding merit."

"What were your plans in coming abroad?" I asked. "To see what could be done in improving the American air communications?"

"Chiefly this," answered the major thoughtfully, "and I think perhaps it might be generalised more advantageously. In the United States I should say that what we now consider commercial aviation in an organised way is only about two and a half years old, which means that in that period of time the operation of scheduled services of air transportation over established airways, partly equipped with various aids to air navigation, has built itself up to a point where, at the present time, there are some 31 air transport organisations operating on the scheduled services approximately 40,000 miles a day for some 19,000 miles of established airways. The services are maintained throughout 24 hours of each day, and one-third of the total mileage is flown at night and all night on schedule. By far the major portion of the revenue is derived from the transport of mail and express.

"Now that has furnished the air transport organisations with operating experience, has enabled the aircraft manufacturers to develop the right type of aircraft, and has enabled the United States Department of Commerce, under which the regulation of civil aviation comes to develop and instal the present known aids to air navigation, such as lighting and equipment, communication service, intermediate fields in the airways, the corps of attendants that are necessary and so on. All this now furnishes an excellent promise for the impending passenger service which will undoubtedly start in a large way this year.

"With these things in mind, and remembering the extensive experience which a number of transport companies have had in Europe in the matter of handling passengers at the aerodromes as well as in transportation to and from the aerodromes, sale of tickets, handling of luggage and so on, my interest for this trip was prompted.

"We have, in the United States, some important passenger services. We have others of importance starting this year, at least two if not three trans-continental services, postal as well, of course; New York to Florida, for instance. There exists a service from Atlanta, Georgia, to Miami and Miami to Havana and from Havana to the West Indies and Panama. There has just been inaugurated a scheduled service to the Pacific and there will be services between New York and San Francisco and from New York to San Francisco and Los Angeles, in addition to a combined air and mail service from New York to Los Angeles and San Francisco. There are, in addition, existing services between Seattle and Portland and San Francisco and from San Francisco and Los Angeles into Mexico."

"What countries in Europe have you visited?" I enquired.

"France, Italy, Germany and Belgium," said Maj. Young.

"And your impressions of their air services?"

"I can only say that I got very good impressions."

"Did you find anything worth adapting to your own processes of civil aviation in America?" I asked.

"Yes," he said, "I think we can learn any number of things, particularly in connection with the facilities with which passengers are handled both in transit to and from the aerodromes and through the administration of the customs services and in getting on and off the 'planes.

"In connection with the entire proposition I have had in mind the following principles. I think everyone agrees that any transportation system involves at least comfort and reliability and the third element is naturally safe speed. Maintain the first two and increase the speed and you will offer advantages which people will pay for. To do this it is recognised that you must have good aircraft, that you must maintain schedules and furnish a service in its fundamentals that will satisfy. The things that remain are the refinements that are made up of the various details which you can only acquire after experience. It is in those things that England and the Continent have had abundant experience and certainly have valuable tips to give the United States.

"Outstanding in connection with the observations I have made in Europe is the completeness of aerodrome equipment, the well-trained ground personnel, the facilities for the moving of passengers to, from and through the aerodrome, in which I naturally include such things as the administration buildings. In this Croydon, Tempelhof and Le Bourget aerodromes are outstanding examples."

"How did you travel for the purposes of making these observations?" I asked Maj. Young.

"Weather permitting, I flew my own 'plane on the Continent, otherwise I travelled by train," he said. "My 'plane is a Stearman biplane, fitted with Wright 'Whirlwind' engine."

"So you visited Croydon, Le Bourget and Tempelhof," I said. "Did you manage to get round to any more?"

"Yes," replied Maj. Young, "I saw some of the private aerodromes in France, for instance the Farman, to see their blind-flying equipment. I also went to Rome where I visited Centocelli and Littorio, and to Milan, as well as going to Paris, Brussels and Rome."

"What did you think of civil aviation in Germany?" I asked.

"I found it as good as any on the Continent of Europe," he said, "certainly in its arrangements. Of course, Germany has a much more extensive area of operation than most of the other countries, that is to say, entirely within the borders of the country itself. The Lufthansa has certainly a very well operated aerodrome. I would say, however, that in a comparative way and in regard to the extent of their operations, Lufthansa and Imperial Airways compare very favourably with one another. Several things enter into it that

all reflect themselves in the financial results and there is one thing in passenger transportation in Europe which does not and probably never will enter into the American situation: that is the direct Government subsidies.

"Our aviation in the United States such as it is and will be, since there is in our system of transportation no subsidy, must make or break itself, therefore what we have has been established as the result of well worked-out plans by business men who have been successful in other lines of transportation as well; and I think it is safe to say that in the majority of cases of the existing companies they are quite well paying their own way and in some instances showing a considerable return.

"The State subsidy as granted to the aviation organisations here, plus what might be termed the State control or management of the important aerodromes, permits perhaps an overhead which contributes to the service what our air transport companies in the United States will have to take into consideration in determining their proposed revenues. But in the United States as in Europe the air transport will be more expensive for some time than surface transport."

"You think it must be more expensive, then?" I queried.

"Yes," said the major, decidedly. "Looking reasonably well into the future I do not think the cost can come down to the level of surface transport. Air transport will be more expensive.

"Look at it from this point of view, for example. Between New York and Chicago we have two rail journeys and extra fare trains. There was, at one time, a doubt as to whether an extra fare would be tolerated. I have seen both those trains, the Pennsylvania and the New York Central go out completely filled. The same is true of trans-continental trains. They are used to capacity when they offer additional comfort which indicates that a comfortable and reliable service, whether by air or otherwise, if it saves time, will be used if available."

"How far do you think you travelled in your machine on this European trip?" I asked Major Young.

"I probably covered by air a total of some 2,000 miles," he replied.

"And do you think flying is essentially a young man's job?"

"No, I can't say that I do," he said, "certainly not so far as scheduled air transportation is concerned. Take the New York Central and Pennsylvania trains, for comparison. Usually the engineers who take those trains from New York to Chicago are elderly men; they are so experienced that they achieve greater speed and are as reliable as the younger men.

"Flying as regards the scheduled transportation of an air liner, carrying passengers and merchandise, is a specialised science which calls not only for piloting but for navigation and the exercise of judgment. In piloting an air liner from Paris to London the actual physical effort involved in flying the ship is almost negligible; you take off once, then during the trip the ship is almost stable, and you land once. The important point is to fly rapidly in all weathers, above or below the clouds. The pilot can be young or middle aged. The physical qualification does count, but there is the large practical side of it.

"Air transport is a comparatively young business. Thus far it has called for the adventurous sort of person who has been hailed as courageous. That is rapidly becoming history, it is becoming a business and the circus element is passing out of the picture and on the civilian side aircraft is being used for what it should be used.

"I do not think it is necessarily a young man's game. I myself have been in it since 1917. I am 39 now and I hope to continue to fly until I am well along in years, 50 or even 60.

"You saw some active service during the war?" I enquired.

"Yes," he answered, "I was in the American Air Service down on the Italian front, attached to the Italian Air Service, where I spent, I think, about a year."

That was all that the Major would say about his years of war. He is henceforth solely a man of peace.

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SIR CHARLES WAKEFIELD'S LUNCHEON TO MAJOR SEGRAVE

On April 23 a luncheon at the Connaught Rooms was given and presided over by Sir Charles Wakefield in honour of Maj. H. O. D. Segrave on his return from America after securing the world's speed record on land and the motor-boat championship of the world. During the luncheon Maj. Segrave, on behalf of Mr. Hubert Scott-Paine and himself, presented to Sir Charles Wakefield a model of the motor-boat *Miss England*, as a token of the esteem in which they held him.

Sir Charles Wakefield, after thanking them for their gift, the outcome of a delightful conspiracy, proceeded to read the following telegram from Captain Malcolm Campbell:

"Please convey to Maj. Segrave my heartiest congratulations once again on his recent wonderful performance. Tell him how glad we all are that he has upheld so magnificently British prestige in America."

Proposing the toast of "Maj. Segrave," Sir William Joynson-Hicks, the Home Secretary, said that Maj. Segrave had accomplished the greatest achievement in motor-car speed that the world had ever known. They were delighted to think that the speed record was made by a British driver driving a British machine backed up by British determination and British patriotism.

Maj. Segrave, in reply, said that sport abroad often had the advantage of unlimited financial backing, while we had gone into it solely from the love of it. Sir Charles Wakefield had for the past 15 or 20 years of his life, and with no possible thought of gain, devoted himself to mechanical forms of sport. He (Maj. Segrave) had always regarded Sir Charles as his adopted father.

Regarding the actual performance of the "Golden Arrow," they were so very likely to forget that without the complete collaboration and unlimited support of Capt. Irving and the seven mechanics who went out to America they could have done absolutely nothing. He wished to pay a very sincere tribute to those mechanics and to thank each one very, very sincerely for the wonderful way in which they carried out their task. He could assure the public that the "Golden Arrow" was capable of 240 miles an hour.

Referring to *Miss England*, he said that it had been suggested that a number of people in England would like to see that boat running. It had been suggested to him that on the occasion of the Duke of York's trophy race, and just before the race started, *Miss England* should travel for a few miles at about 85 or 90 miles an hour just to give people an idea of what a wonderful boat she was.

Segrave Items

Col. The Master of Sempill gave a dinner at the Stadium Club, White City, in honour of Major Segrave and Captain Irving, before the special welcome organised for them at the Motor-cycle Speedway.

The Institution of Automobile Engineers has awarded its gold medal to Captain J. S. Irving, designer of the Irving-Napier car *Golden Arrow*, in which Major H. O. D. Segrave established a world's speed record at Daytona. This award has previously been made by the institution to only six other recipients, and is extended to Captain Irving in view of the success of the *Golden Arrow* and his valuable contributions to automobile science and progress in general.

Madame Tussaud's, in keeping with its reputation for topicality, has added to the Exhibition a portrait-model of Maj. H. O. D. Segrave. The model, which is considered to be an excellent likeness, is exhibited in the Sporting section in company with aviators and other celebrities who have made sporting history.

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Air Mail Arrangements

The Postmaster announces that, in consequence of the later departure of this service from France, Air Mails for West Africa and South America now close at the G.P.O., London, at 6 p.m. every Friday instead of Wednesday, with a supplementary despatch at 6 a.m. every Saturday instead of Thursday. Also, an air mail service is now available from Nuevo Laredo, on the U.S.A.-Mexico frontier *via* San Luis Potosi to Mexico City, connecting with the service from New York. It is available for air mail of all classes, registered and unregistered, except parcels, on the usual conditions. The rates are a special air fee of 1*s.* 2*d.* per oz. in addition to the ordinary postage. The gain in time to Mexico City is from 2 to 2½ days.

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The AIRCRAFT ENGINEER

FLIGHT ENGINEERING SECTION

Edited by C. M. POULSEN

April 25, 1929

CONTENTS

EDITORIAL VIEWS.

After a long absence Mr. Pollard returns to our columns this week with an article dealing with the calculation of moments of inertia, etc., of beams made up of corrugated strip of small thickness. Mr. Pollard points out that in the case of ordinary box sections, such as those in use when we still built aircraft with wooden spars, the draughtsman could easily remember the formulæ, or else could look them up in almost any text book on structures. For the new corrugated strip sections used in the construction of metal wing spars in steel or Duralumin no information is yet included in text books, and we therefore feel that a large number of draughtsmen and designers will be very glad to have the friendly advice which Mr. Pollard has to offer. During some years with the Bristol Aeroplane Company Mr. Pollard has had a very wide experience in the design, manufacture and use of metal aircraft structures, and at the present moment he is engaged upon work of extraordinary interest, some of the results of which we hope he will share with us and our readers by giving an account in THE AIRCRAFT ENGINEER. For the present, however, this work is of a confidential nature, and we must await developments.

In view of the impending attempt by the Fairey monoplane with Napier "Lion" engine to beat the existing world's records for distance and duration without alighting, the article which we publish this week, by Mr. R. J. Nebesar, should be of considerable interest. Mr. Nebesar is on the technical staff of General Airplanes Corporation, of Buffalo, New York, and his treatment of the subject of range is somewhat unusual. For instance, we do not remember previously having seen the theory advanced that for best results the sum of parasite and profile drags should equal the induced drag, at the angle of minimum resistance. This appears to lead to rather low aspect ratios for machines intended to make long non-stop flights, and the views of British designers on the subject would be welcomed.

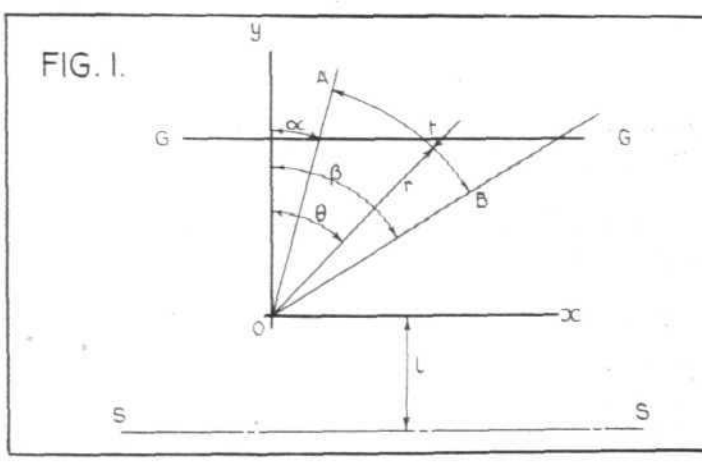
The use of the nomograph is far less general than it deserves, and as we rather share the views of Mr. Rodger that the average draughtsman "funks" it as being too difficult, we are glad to publish Mr. Rodger's explanation of its construction and use.

DEVELOPMENT OF METAL CONSTRUCTION.

By H. J. POLLARD, Wh.Ex., A.F.R.Ae.S.

(Continued from December 27, 1928, issue.)

One of the difficulties of the individual who has not learned a little very elementary calculus, and who wishes to be able to design beams, etc., from thin metal, lies in not being able to compute rapidly the constants of corrugated sections. For ordinary box or girder sections of timber there is no difficulty; the draughtsman can remember the necessary formulæ, or easily turn them up in almost any handbook bearing on engineering, but formulæ for corrugated shapes are not as yet published in the usual handbooks, and it is fitting that we should discuss some of these. In the first instance, then, we will take a simple case and establish a formula for the moment of inertia of a circular arc or, more correctly, circular annulus, which is usually referred to as an arc, about any axis, which in this instance is typified by the line SS as shown in Fig. 1.



Let AB (Fig. 1) then be such a circular annulus of thickness t which is small compared with r, the radius of the arc.

The centre of the arc is taken as origin of co-ordinates, and the radii OA and OB drawn from the origin through A and B make angles α and β respectively with oy the axis of y. Any radius typified by OP makes an angle θ with oy.

The length of an element is $rd\theta$, its width t, and its distance from the axis SS is $l+r \cos \theta$, consequently its moment of inertia about SS is $rt\,(l + r \cos \theta)^2\, d\theta$, and we have for the whole annulus

$$\frac{I_{ss}}{t} = r\int_\alpha^\beta (l + r\cos\theta)^2\,d\theta = r\int_\alpha^\beta (l^2 + 2lr\cos\theta + r^2\cos^2\theta)\,d\theta$$

$$= r\int_\alpha^\beta \left\{ l^2 + 2lr\cos\theta + \frac{r^2}{2}(1 + \cos 2\theta)\right\} d\theta$$

$$= r\left[\left(l^2 + \frac{r^2}{2}\right)\theta + 2lr\sin\theta + \frac{r^2}{4}\sin 2\theta\right]_\alpha^\beta$$

$$= r\left[\left(l^2 + \frac{r^2}{2}\right)(\beta - \alpha) + 2\,lr\sin(\beta - \alpha) + \frac{r^2}{4}(\sin 2\beta - \sin 2\alpha)\right]$$

In what follows we are concerned with the particular case:

$$\alpha = 0$$
$$l = 0$$
$$\beta = \beta$$

That is to say, with the moment of inertia about ox of an annulus beginning on oy struck from centre 0 and subtending an angle β at 0.

Then

$$\frac{I'_{ox}}{t} = \frac{r^3}{2}\left[\beta + \frac{\sin 2\beta}{2}\right] \qquad \text{(1)}$$

Then $\bar{y} = \dfrac{r\sin\beta}{\beta}$ .... (2)

The relationship between $\bar{y}$ and β in this equation is shown plotted in Graph I.

Now by using the theorem of parallel axes we are able to calculate the moment of inertia of the arc AB (Fig. 1) about the axis GG, which passes through its centre of gravity.

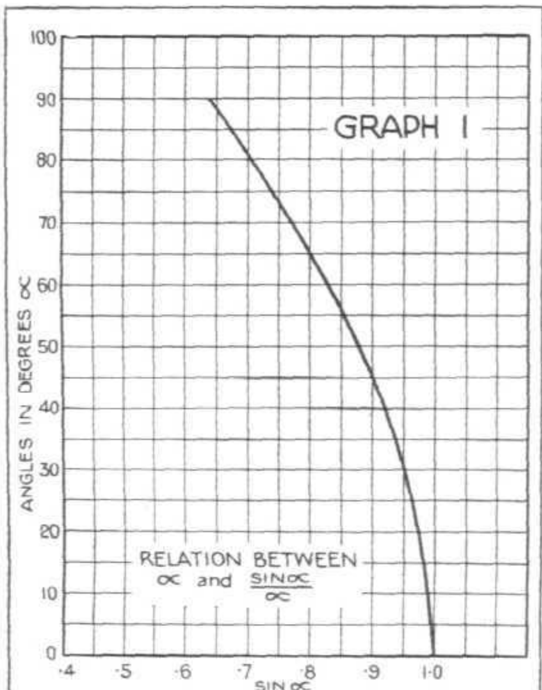
A statement of the theorem as applied to an arc is: If the length of an arc be L and the radius of gyration about any axis passing through its centroid be k, then the moment of inertia of the arc about any parallel axis distance C from the centroidal axis is $L(k^2 + C^2)$. This "theorem of parallel axes" applies equally to the moment of inertia of surfaces or to masses, consequently the moment of inertia of the arc AB about the axis GG through the centre of gravity and parallel to ox is by (1a) and (2).

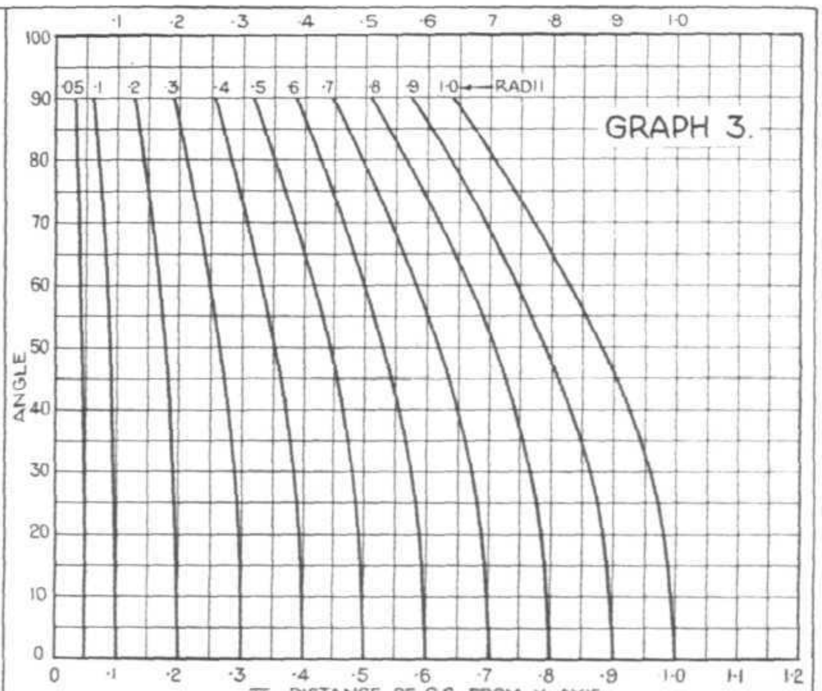
$$\frac{r^3}{2}\left(\beta + \frac{\sin 2\beta}{2}\right) - \frac{r\beta \times r^3\sin^2\beta}{\beta^2}$$
$$= \frac{r^2}{2}\left[\beta + \frac{\sin 2\beta}{2} - \frac{2\sin^2\beta}{\beta}\right] \qquad \text{(3)}$$

Equation 3 is shown plotted on graph 2

$$\left(\alpha + \frac{\sin 2\alpha}{2} - \frac{2\sin^2\alpha}{\alpha}\right)$$

against α in degrees.





As we are not considering how variations of t affect the matter we may write

$$I'_{ox} = I_{ox} \times t$$

where I_{ox} is the moment of inertia of an *arc* without breadth. We then get

$$I_{ox} = \frac{r^3}{2}\left(\beta + \frac{\sin 2\beta}{2}\right) \qquad \text{(1}a\text{)}$$

Again, to find the vertical distance designated by $\bar{y}$ of the centre of gravity of the arc above SS, we have in the general case, the area of the element being as before

$$\bar{y} = \frac{r\int_\alpha^\beta (l + r\cos\theta)\,d\theta}{r(\beta - \alpha)} = \frac{(l\theta + r\sin\theta)_\alpha^\beta}{\beta - \alpha}$$
$$= \frac{l(\beta - \alpha) + r(\sin\beta - \sin\alpha)}{\beta - \alpha}$$

We are concerned with the particular case in which

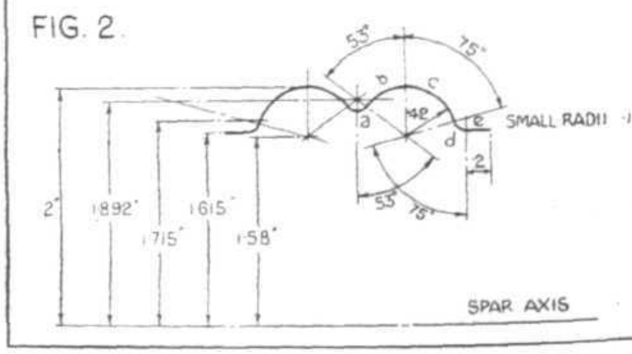
$$\alpha = 0$$
$$l = 0$$
$$\beta = \beta$$

The whole range taken cannot be shown on one ordinary sized chart as a continuous curve, so that for the small angles radii the horizontal scale is a hundred times that for angles of 30° and over.

Graph 3 gives $\bar{y}$ for a number of values of r and similar curves should be plotted from equation 3, thus I_{cg} for a large range of arcs could be read off directly.

Now with these graphs the moment of inertia of a contour consisting of arcs of circles and flats can be rapidly obtained.

FIG. 2.



The method will best be illustrated by means of an example. Let us consider the flange only by a spar say 4-in. deep; this section is shown in Fig. 2.

The various values are shown tabulated in Table I. The values of $\bar{y}$ are read off the curves in Graph 3. The values of c are obtained by simple addition or subtraction and I_{cg} is taken from Graph 2.

TABLE I.

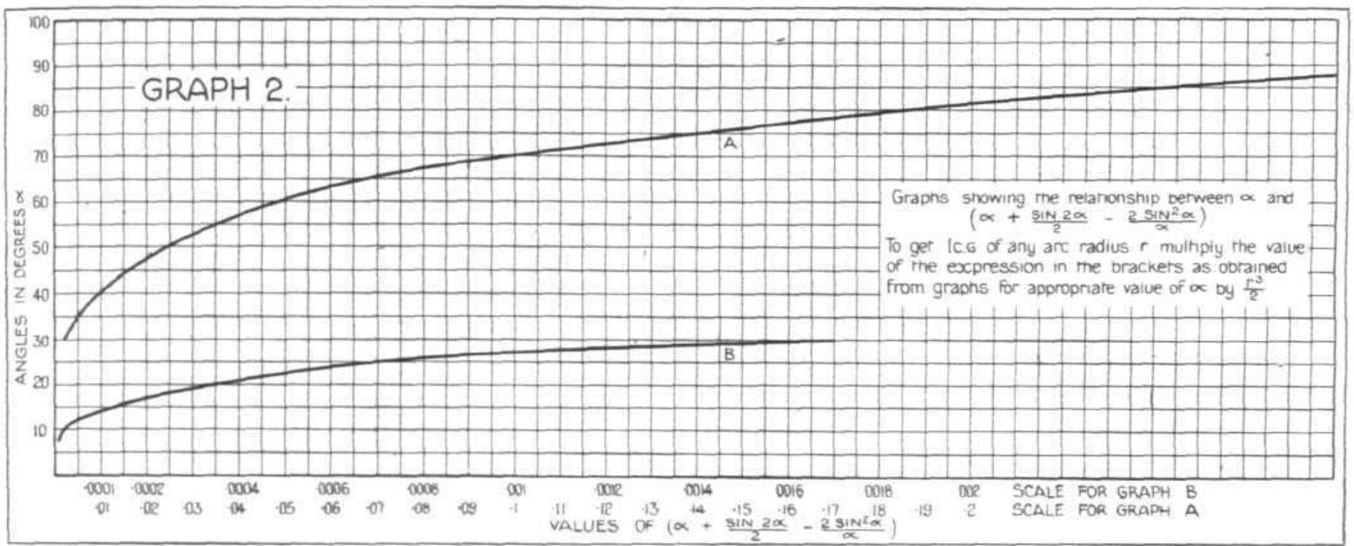
Part of Contour.	Length.	y	c	Ac^2	I_{cg}
a	0·0925	0·086	1·806	0·302	Negligible
b	0·389	0·365	1·945	1·47	0·0011
c	0·55	0·31	1·89	1·965	0·0050
d	0·1309	0·075	1·64	0·352	Negligible
e	0·2	0·0	1·615	0·522	0·0
				4·611	0·0061

Therefore, I of half flange about horizontal axis through C G of spar $= 4\cdot617 \times t$.

of the section and as the "y" and "A" are known, the fibre stresses in a spar when given loads come on to it can be determined, if the assumption that the ordinary methods of estimating stresses for thick walled "boxes," etc., applies equally well for thin walled sections inside the elastic range is made. The stress at which elastic instability is likely to set in must be estimated for these flanges, webs, etc., and this estimation involves finding the moment of inertia or radius of gyration of these parts about various axes. Usually a determination of the "k" about an axis passing through the centroid of the flange parallel to the spar axis is sufficient.

The calculation may be made in an exactly similar manner to that described above, but it frequently happens that terms which may be ignored in calculating the constant for the whole spar are relatively too big to be ignored in calculating the constant for a component part.

As illustrating this matter, Fig. 3 is identical with Fig. 2, so far as radii and angles are concerned, but the horizontal centroidal axis is shown, and the centres of curvature are given in relation to this line.



It is seen that the figures in the sixth column are practically ineffective and could be ignored, moreover, in such a case as this it is unnecessary to get the position of the centres of gravity of the small arcs from the graphs, the distance of the centres of radii from the inertia axis, taken directly from the drawing, giving all the accuracy required.

The following is the expression for the moment of inertia of the flange when estimated in the usual way:—

$$\frac{I}{2t} = 0\cdot1\int_0^{53}(1\cdot892 - 0\cdot1\cos\theta)^2 d\theta$$

$$+0\cdot42\int_{-53}^{75}(1\cdot58 + 0\cdot42\cos\theta)^2\, d\theta$$

$$+\,0\cdot1\int_0^{75}(1\cdot715 - 0\cdot1\cos\theta)^2\, d\theta + 0\cdot2 \times 1\cdot615^2$$

By using equation (1) the result is eventually arrived at, but the work is laborious and unless one is continually making such calculations the chances of error are considerable. By using the graphs the result is arrived at in a fraction of the time and to the necessary degree of accuracy.

We have considered a case of the moment of inertia of a flange about the central axis of the spar. The moment of inertia of the web about the same axis can be obtained in a similar manner, thus giving the total moment of inertia

FIG. 3.

The complete expression for the moment of inertia of the section about this axis is:

$$\frac{I}{2t} = 0\cdot1\int_0^{53}(0\cdot1\cos\theta - 0\cdot036)^2 d\theta$$

$$+\,0\cdot42\int_{-53}^{75}(0\cdot42\cos\theta - 0\cdot276)^2\, d\theta$$

$$+\,0\cdot1\int_0^{75}(0\cdot141 + 0\cdot1\cos\theta)^2\, d\theta + 0\cdot2 \times 0\cdot241^2$$

By using our graphs we can quickly tabulate and obtain the result as indicated in Table II.

TABLE II.

Part.	Length.	y	c	A C²	I_{cg}
a	0·0975	0·086	0·05	0·000244	Negligible
b	0·3886	0·363	0·087	0·00299	0·0011
c	0·55	0·31	0·034	0·000636	0·005
d	0·1309	0·074	0·215	0·00605	Negligible
e	0·2	0·0	0·241	0·0116	0·0
				0·02147	0·0061

As before, y and I cg are read from the graphs. $I = 0\cdot02757 \times t$. In this case then, two terms which were negligible in the overall constant are of importance here. A computation such as the above is not a long job; nevertheless the time can be shortened by a judicious choice of centres and the ignoring of terms which are obviously unimportant at the outset.

The graphs may, of course, be extended to cover a larger range of angles and radii, also, at the expense of some complication in plotting the large arc could be dealt with as one whole, instead of dividing it into portions b and c, but it is doubtful if this is worth while.

The reader will have noted that in obtaining formula 1

angles were measured from the vertical axis *oy*. If the values of the spar "constants" about the vertical axis *oy* are required, or if angles are measured from the horizontal axis, a length m replacing l, expression for integration is:

$$r\int_\alpha^\beta (m + r\sin^2\theta)\,d\theta = r\int_\alpha^\beta (m^2 + 2\,mr\sin\theta + r^2\sin^2\theta)\,d\theta$$

$$= r\int_\alpha^\beta \left[m^2 + 2\,mr\sin\theta + \frac{r^2}{2}(1 - \cos 2\theta)\right]d\theta$$

Giving

$$r\left[\left(m^2 + \frac{r^2}{2}\right)\theta - 2\,mr\cos\theta - \frac{r^2}{4}\sin 2\theta\right]_\alpha^\beta$$

$$= r\left[\left(m^2 + \frac{r^2}{2}\right)(\beta - \alpha) - 2\,mr\,(\cos\beta - \cos\alpha) - \frac{r^2}{4}(\sin 2\beta - \sin 2\alpha)\right]$$

When

$$\alpha = 0 \qquad m = 0 \qquad \beta = \beta$$

the expression reduces to

$$\frac{I_{oy}}{r} = \frac{r^3}{2}\left(\beta - \frac{\sin 2\beta}{2}\right)$$

The distance of the centre of gravity from o_y is

$$\bar{x} = \frac{\int_\alpha^\beta (m + r\sin\theta)\,d\theta}{r(\beta - \alpha)} = \frac{m(\beta - \alpha) - r(\cos\beta - \cos\alpha)}{r(\beta - \alpha)}$$

when

$$m = 0 \qquad \alpha = 0 \qquad \beta = \beta$$

$$\bar{x} = \frac{r\,(1 - \cos\beta)}{\beta} \quad \ldots\ldots\ldots\ldots \quad (5)$$

Then

$$\frac{I_{cg}\text{ vertical}}{t} = \frac{r^3}{2}\left[\beta - \frac{\sin 2\beta}{2} - \frac{2(1 - \cos\beta)^2}{\beta}\right] \quad \ldots (6)$$

From expressions (5) and (6) a set of graphs showing corresponding values of I_{cg}, r and β can be plotted. With such a set of charts at hand, the determining of the necessary constants for complicated sections made up of circular arcs and straight lines is easily and quickly carried out.

THE THEORY OF LONG-DISTANCE FLIGHT.

By ROBERT J. NEBESAR

In this theoretical discussion of the factors of long-distance flight the following nomenclature will be employed. The theoretical parts are based on the metric system. The coefficients are in the absolute and not the engineering values. American units are used in all charts for practical use in conjunction with metric units.

A = area of wings in square metres
b = span of wings in metres
B_0 = engine brake horse-power at sea level
B_h = engine brake horse-power at altitude h metres above sea level
B_t = engine brake horse-power at moment t
c_s = specific fuel consumption in kilograms per horse-power/hour
C = coefficient of total drag
$C_{D\,ind}$ = coefficient of induced drag
$C_{D\,prof}$ = coefficient of profile drag
$C_{D\,struc}$ = coefficient of structural drag (parasite drag) in the polar diagram (recalculated on the unity of the area of wings)
C_L = coefficient of lift
D = total drag in kilograms
D_h = total drag at altitude h metres above sea level, in kilograms
D_{ind} = induced drag in kilograms
D_{prof} = profile drag in kilograms
D_{struc} = structural drag in kilograms
ϵ = efficiency of the propeller
$\phi = \dfrac{C_{D\,prof} + C_{D\,struc}}{C_{D\,prof}}$ = ratio of total unuseful drag to profile drag
g = acceleration of gravity in metres per second per second
h = a certain altitude during the flight, in metres
H = absolute ceiling of the aeroplane, in metres
H_{th} = theoretical ceiling of the aeroplane, in metres
$\lambda = \dfrac{b^2}{A}$ = aspect ratio of wing
L_B = power loading at the beginning of flight, in kilograms per horse-power*
L_W = wing loading at the beginning of flight, in kilograms per square metre
p_0 = specific weight of the air at sea level
p_h = specific weight of the air at altitude h metres above sea level
R = maximum cruising radius of an aeroplane at the variable speed, in kilometres
R_{const} = maximum cruising radius at the constant speed, in kilometres
t = a certain moment during the flight
T = duration of the flight for the distance R, in hours
T_c = duration of the flight for the distance R_{const}, in hours
V = speed in metres per second
V_0 = speed at sea level, in metres per second
V_h = speed at altitude h metres above sea level, in metres per second
V_t = speed at moment t, in metres per second
$w = \dfrac{W_f}{W}$ = ratio of the fuel weight to the total weight of an aeroplane at the beginning of flight
W_f = weight of fuel in kilograms
W = total weight of an aeroplane in kilograms
W_t = total weight of an aeroplane at the moment t, in kilograms

1. Speed at Minimum Drag.

The primary factor for a successful long-distance flight is the minimum consumption of fuel for a given distance.

We shall assume a monoplane flying at a constant altitude at sea level, also that the engine has surplus power which will enable the plane to climb.

The total drag of an aeroplane consists of three parts, which are the induced, the profile, and the parasite drag. The profile and parasite drags are unuseful.

$$\text{The induced drag } D_{ind} = \frac{2g}{p}\cdot\frac{W^2}{\pi\cdot V^2\cdot b^2}$$

$$\text{The profile drag } D_{prof} = \frac{p}{2g}\cdot C_{D\,prof}\cdot A\cdot V^2$$

$$\text{The parasite drag } D_{struc} = \frac{p}{2g}\cdot C_{D\,struc}\cdot A\cdot V^2$$

The foregoing formula for the induced drag is correct for the elliptical lift distribution. For any other distribution of the lift we shall include the increase of the induced drag in

* The power loading is taken at the start of the flight, after the desired altitude has been reached and aeroplane has started for its objective.

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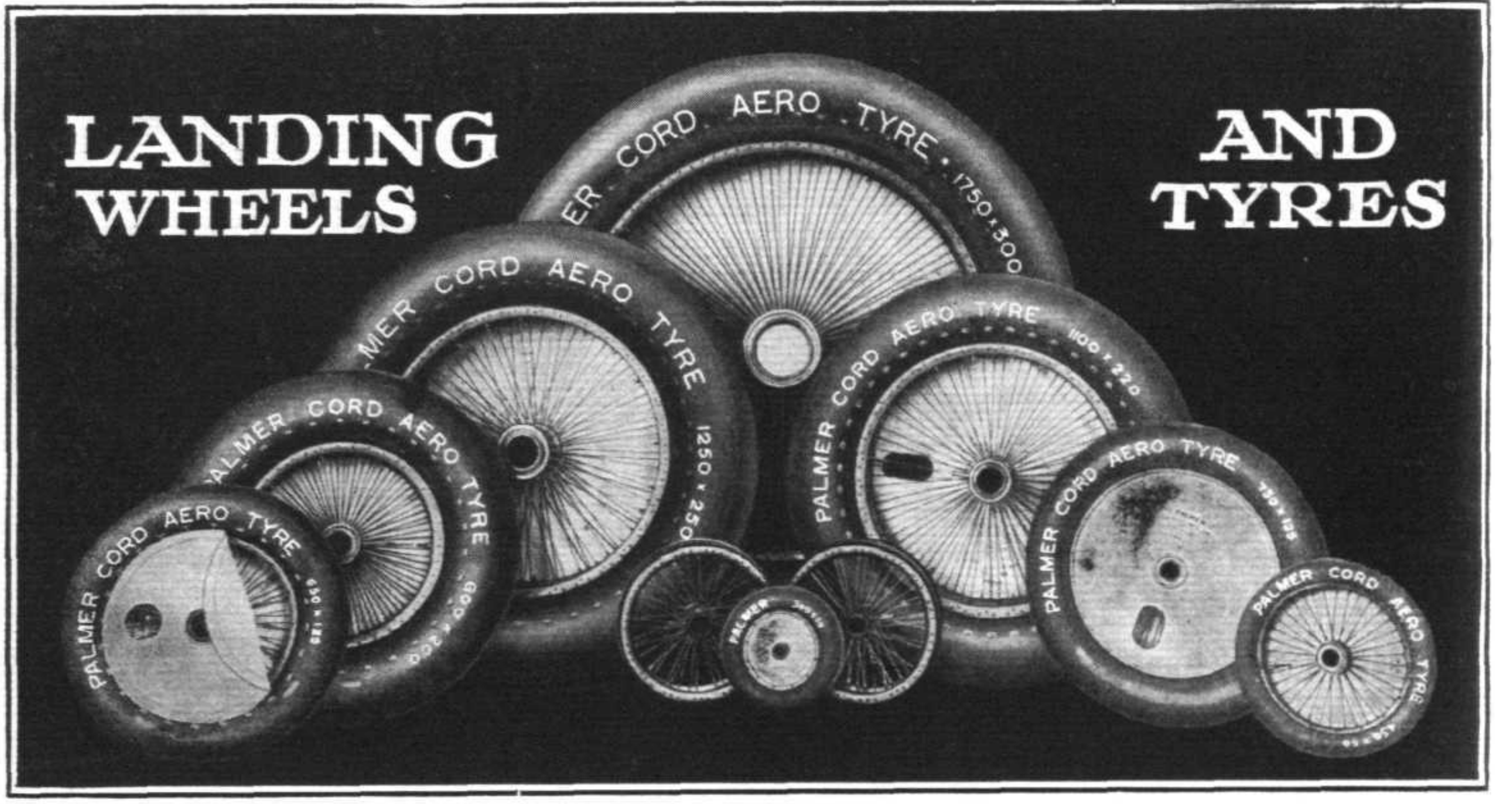

STANDARD SIZES.

Tyre Size	Wheel No.	Hub Length	Hub Bore	Track Line
		m/m	m/m	m/m
375 × 55	168	111·12	25·4	Central
"	195	130·	38·09	Central
300 × 60	16	111·12	25·4	Central
450 × 60	30	89·	31·75	Central
"	172	130·	38·09	Central
575 × 60	21	160·	28·	Central
"	180	150·	38·09	104/46
"	186	120·	34·92	Central
"	190	150·	38·09	Central
600 × 75	21	160·	28·	Central
"	180	150·	38·09	104/46
"	186	120·	34·92	Central
"	190	150·	38·09	Central
700 × 75	78	178·	44·45	132/46
"	79	178·	44·45	Central
"	100	178·	38·09	132/46
"	101	178·	31·75	132/46
"	196	178·	55·	Central
600 × 100	188	120·	34·92	Central
"	304	150·	38·09	104/46
"	333	120·	34·92	Central
700 × 100	77	178·	44·45	132/46
"	92	185·	55·	135/50
"	95	185·	55·	Central
"	99	178·	38·89	132/46
"	112	150·	38·09	Central

Tyre Size	Wheel No.	Hub Length	Hub Bore	Track Line
		m/m	m/m	m/m
700 × 100	176	178·	44·45	Central
"	179	178·	55·	132/46
650 × 125	119	178·	55·	132/46
"	147	178·	55·	Central
"	188	120·	34·92	Central
"	336	178·	44·45	132/40
750 × 125	77	178·	44·45	132/46
"	92	185·	55·	135/50
"	95	185·	55·	Central
"	99	178·	38·89	132/46
"	112	150·	38·09	Central
"	176	178·	44·45	Central
"	179	178·	55·	132/46
800 × 150	161*	185·	55·	135/50
"	162*	185·	55·	Central
"	163*	185·	66·67	135/50
"	169†	185·	55·	135/50
"	177	185·	55·	135/50
"	183	185·	55·	Central
"	211*	185·	60·32	135/50
1000 × 150	167	185·	55·	125/60
"	174	250·	80·	Central
"	182	185·	55·	Central
"	187	220·	66·67	Central
"	201	185·	60·32	125/60
"	210	185·	60·32	Central

Tyre Size	Wheel No.	Hub Length	Hub Bore	Track Line
		m/m	m/m	m/m
1000 × 180	148	220·	80·	Central
"	149	185·	55·	Central
"	155	220·	66·67	Central
"	166	185·	55·	125/60
900 × 200	107	185·	55·	Central
"	108	185·	55·	125/60
"	128	220·	66·67	Central
"	137	250·	80·	Central
"	157	185·	80·	Central
"	202	185·	60·32	Central
1100 × 220	134	220·	66·67	Central
"	136	250·	80·	Central
975 × 225	192	185·	60·32	Central
"	194	185·	55·	125/60
1250 × 250	314	250·	80·	Central
"	154	304·8	101·6	Central
1500 × 300	305	304·8	152·4	Central
"	306	304·8	101·6	Central
1525 × 325	197	304·8	101·6	Central
1750 × 300	139	400·	152·4	Central
"	191	350·	150·3	Central
1750 × 350	193	400·	125·	Central

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the profile drag (the difference of which is from 2 to 5 per cent. for conventional wing forms).

The total drag is

$$D = \frac{2g}{p} \cdot \frac{W^2}{\pi \cdot b^2} \cdot \frac{1}{V^2} + \left(\frac{p}{2g} \cdot C_{D\,prof} \cdot A + \frac{p}{2g} \cdot C_{D\,struc} \cdot A\right) \cdot V^2 \qquad \text{.............. (1)}$$

which, simplified, is

$$D = \frac{\alpha}{V^2} + \beta \cdot V^2$$

where

$$\alpha = \frac{2g}{p} \cdot \frac{W^2}{\pi \cdot b^2} \text{ and } \beta = \frac{p}{2g} \cdot A\,(C_{D\,prof} + C_{D\,struc}) = \frac{p}{2g} \cdot A \cdot C_{D prof} \cdot \phi$$

The value α is constant for a given type of aeroplane. The value β changes with the polar curves of different aerofoils, and therefore for a given type of aeroplane with the angle of attack, which latter depends on the polar curve of the aerofoil as well as on the parasite resistance. For our case we may assume with a sufficient degree of accuracy that this value β will be also constant in the proximity of the angle of the minimum drag.

Differentiating Equation (1), we obtain the minimum drag.

$$\frac{dD}{dV} = -\frac{2\alpha}{V^3} + 2\beta \cdot V = 0$$

that is, the speed is

$$V = \sqrt[4]{\frac{\alpha}{\beta}} = \sqrt[4]{\left(\frac{2g}{p}\right)^2 \cdot \frac{W^2}{\pi \cdot b^2 \cdot C_{D\,prof} \cdot A}} \quad \ldots (2a)$$

and the minimum drag will be

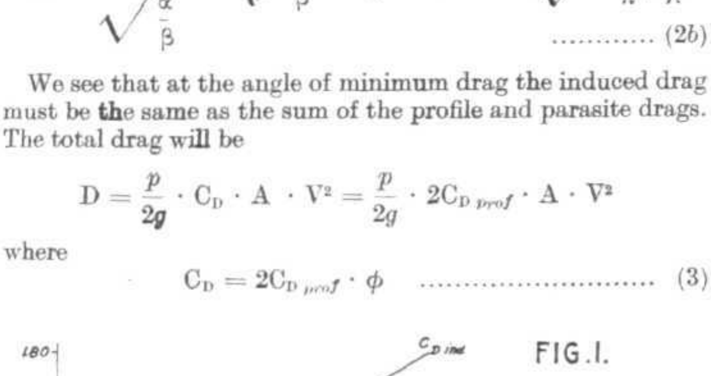
$$D_{min} = \frac{\alpha}{\sqrt{\frac{\alpha}{\beta}}} + \beta\sqrt{\frac{\alpha}{\beta}} = 2\sqrt{\alpha \cdot \beta} = 2W\sqrt{\frac{C_{D\,prof} \cdot \phi}{\pi \cdot \lambda}} \qquad \text{............ (2b)}$$

We see that at the angle of minimum drag the induced drag must be the same as the sum of the profile and parasite drags. The total drag will be

$$D = \frac{p}{2g} \cdot C_D \cdot A \cdot V^2 = \frac{p}{2g} \cdot 2C_{D\,prof} \cdot A \cdot V^2$$

where

$$C_D = 2C_{D\,prof} \cdot \phi \qquad \text{.......................... (3)}$$



This point on the polar curve indicates the best angle of attack; that is, the maximum L/D of the total plane (*see* Fig. 1.)

This relation has been generally known since 1860—for example, Penaud; Lancaster, "Aerodynamik," vol. I, p. 199; Eberhardt, "Flugtechnik," p. 38—but has been expressed in different ways.

Another consideration: the minimum of the engine output, from which we assume the minimum of the total weight of the aeroplane, is given by differentiating the equation

$$75 \cdot \epsilon \cdot B \cdot = D \cdot V = \frac{\alpha}{V} + \beta \cdot V^3$$

from which we find that the minimum engine output occurs at the speed

$$V = \sqrt[4]{\frac{\alpha}{3\beta}}$$

This speed is 76 per cent. of the speed of minimum drag.

The most important factor for a long-distance flight is the minimum consumption of fuel for a given distance and not the weight of the engine (the engine weight being approximately equivalent to a five-hour supply of fuel).

The minimum consumption of fuel will be at the minimum value of

$$\frac{\text{horse-power} \times \text{time}}{\text{distance}} = \frac{\text{horsepower}}{\text{velocity}} = \text{drag}$$

This relation is shown in Fig. 1, where the hatched area represents the case of modern transport aeroplanes.

From this we find that, flying at the speed of about 100 m.p.h. (160 km.p.h.), the induced drag is only 20 per cent. of the total drag, which is not economical.

At 50 per cent. of the induced drag we find that the speed is about 70 m.p.h. (110 km.p.h.) only, which is insufficient. To remain on the minimum cruising speed of 100 m.p.h. we have to determine the aerodynamic conditions within reasonable limits.

To obtain easy control of the aeroplane at the most efficient angle of attack we have to choose the corresponding lift which would give us the greatest difference between the minimum speed of horizontal flight and the speed at the minimum of drag. The best aerofoils have a maximum lift coefficient of about $C_L = 1 \cdot 4$; therefore a corresponding maximum lift coefficient of about $0 \cdot 7$ can be chosen. The control of the plane will be better when flying in a high altitude and with a reserve of power, which is also necessary for take-off.

This also solves the problem of low landing speed, which will be referred to further on.

2. The Reciprocal Relations of the Aerodynamic Values.

We shall assume that the total weight does not change during the duration of the flight, and therefore that the speed and power remain constant.

Normally, with a decreasing distance the weight of fuel decreases; to fly at the best angle of attack we must reduce progressively the speed and also the engine output, which causes an increase of cruising radius. These mathematical relations will be determined in the next section, and the results will then be corrected.

The weight of fuel required to drive the engine during the time T will be

$$W_f = B \cdot c_s \cdot T \qquad \text{.. (4)}$$

where

$$W_f = w \cdot W$$

Substituting for B from the equation previously given, we have

$$w \cdot W = \frac{D \cdot V \cdot c_s \cdot T}{75 \cdot \epsilon}$$

and substituting for D from Equation (2b), we obtain the economical speed

$$V = \frac{75\epsilon \cdot w}{2c_s \cdot T}\sqrt{\frac{\pi \cdot \lambda}{C_{D\,prof} \cdot \phi}} \qquad \text{.......................... (5)}$$

This speed will change as the value of w changes during the flight. From Equation (4) we find that the power loading will be

$$L_B = \frac{T \cdot c_s}{w} \qquad \text{.. (6)}$$

and from Equation (2*a*), by substituting $\lambda \cdot A$ for b^2, the wing loading will be

$$L_W = \frac{p}{2g} \cdot V^2 \cdot \sqrt{\pi \cdot \lambda \cdot C_{D\,prof} \cdot \phi} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad 7a)$$

$$C_L = \sqrt{\pi \cdot \lambda \cdot C_{D\,prof} \cdot \phi} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (7b)$$

We then find that the speed over the total distance will be

$$V = \frac{R_{const}}{3 \cdot 6T}$$

in which, substituting for T from (6),

$$V = \frac{1}{3 \cdot 6 L_B} \cdot \frac{R_{const} \cdot c_s}{w} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (8)$$

which, substituted in (5), gives

$$\sqrt{\frac{\lambda}{C_{D\,prof} \cdot \phi}} = \frac{2}{3 \cdot 6 \times 75\sqrt{\pi} \times \epsilon} \cdot \frac{R_{const} \cdot c_s}{w} \quad (9)$$

In Fig. 2 we have determined the relation of the aerodynamic values from Equations (7*a*), (7*b*), (8) and (9). We assume that the efficiency of the propeller does not change (this is true for a flight at constant angle of attack in different altitudes, as will be demonstrated in the next section), and also the specific fuel consumption does not change (we must take an average value, because by flying with the same angle of attack, and therefore reducing the power required, the specific fuel consumption will increase).

The group of curves A of Fig. 2 represent the equation $L_w = f(V, C_L)$. The values of wing loading L_w are given from 10·25 to 24·6 lb. per sq. ft. (50 to 120 kg. per sq. m.). The group of curves B represent the relation $V = f\left(L_B, \frac{R_{const} \cdot c_s}{w}\right)$ for the values of power loading $L_B = 19 \cdot 85$ to $39 \cdot 7$ lbs. per h.p. (9 to 18 kg. per h.p.). Curves A and B are connected by means of the value V.

The group of curves C refer to $\lambda = f\left(C_{D\,prof} \cdot \phi, \frac{R_{const} \cdot c_s}{w}\right)$. The values of $C_{D\,prof} \cdot \phi$ run from 0·0260 to 0·0455. For the same values of $C_{D\,prof} \cdot \phi$ are given the curves forming the relation $C_L = f(\lambda, C_{D\,prof} \cdot \phi)$ at D. The value $\frac{R_{const} \cdot c_s}{w}$ connects the curves B and C, the value λ connects the curves C and D, and the value C_L connects the curves D and A.

The value $C_{D\,prof} \cdot \phi$ is determined for the value $C_{D\,prof} = 0 \cdot 013$ (that is, the coefficient of profile drag of the current aerofoils in the proximity of the angle of attack at the minimum drag) and the values $\phi = 2, 2 \cdot 5, 3$, and $3 \cdot 5$ (the values 2·5 to 3·5 correspond to actual transport aeroplane constructions). For any different values of $C_{D\,prof}$ it would be possible by calculation to remain within these curves.

The value $\frac{R_{const} \cdot c_s}{w}$ is divided in the lower part of the Fig. 2 in its components:

The values of specific fuel consumption $c_s = 0 \cdot 485$ to $0 \cdot 615$ lbs. per h.p.-hour (0·220 to 0·280 kg. per h.p.-hour) at F, and values of the ratio of the fuel weight to the total weight $w = 0 \cdot 4$ to $0 \cdot 6$ at G, which are indicated by the dotted lines. At E are given the values of different propeller efficiencies $\epsilon = 0 \cdot 6$ to $0 \cdot 8$; this manipulation is made by the use of 45-degs. inclined lines, as shown in Fig. 2.

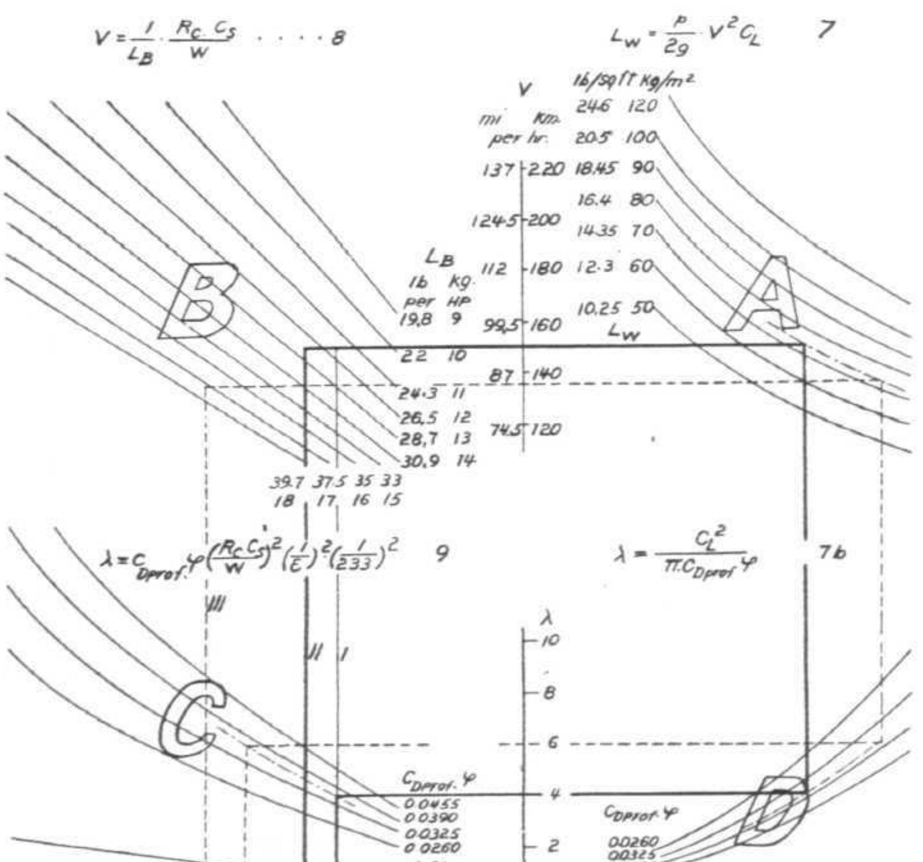


FIG. 2.

The values $w = 0 \cdot 4$ to $0 \cdot 6$ at G, which are designated by full lines, correspond to the corrected values of the cruising radius for an economical flight at the constant angle of attack (see Fig. 5).

From the values w we finally obtain the values of the cruising radius R = 2,500 to 5,000 miles (4,000 to 8,000 km.).

In order to show how to use this diagram (Fig. 2) we have drawn in an example, in which we have assumed the following:

The starting speed 93 m.p.h. (150 km.p.h.) at the coefficient of lift $C_L = 0 \cdot 7$ max. For an aerofoil whose maximum lift coefficient $= 1 \cdot 4$, the theoretical landing speed with the initial wing loading will be $= 93\sqrt{\frac{0 \cdot 7}{1 \cdot 4}} = 66$ m.p.h.

For the coefficient of profile drag $C_{D\,prof} = 0 \cdot 013$ and for the coefficient of structural drag $C_{D\,struc} = 0 \cdot 024$, the value $C_{D\,prof} \cdot \phi$ will be 0·037 and $\phi = \frac{0 \cdot 037}{0 \cdot 013} = 2 \cdot 85$.

All other aerodynamic values are determined in the diagram by the rectangle I. For a propeller efficiency $\epsilon = 70$ per cent., this solution is as follows:

The wing loading $L_W = 15 \cdot 15$ lb. per sq. ft., the power loading $L_B = 25 \cdot 8$ lb. per h.p., $C_L = 0 \cdot 68$, and the aspect ratio $\lambda = 4$. For a specific fuel consumption of 0·55 lb. per h.p.-hour (250 g.) and for $w = 0 \cdot 535$ (see Fig. 4), the maximum cruising radius will be 3,260 miles.

Assuming a higher propeller efficiency of $\epsilon = 75$ per cent. (see rectangle II), the maximum cruising radius will be 3,540 miles and the power loading $L_B = 27 \cdot 55$ lb. per h.p.

We see that for this case the best aspect ratio is 4, this being due to the low cruising speed, which is given by the condition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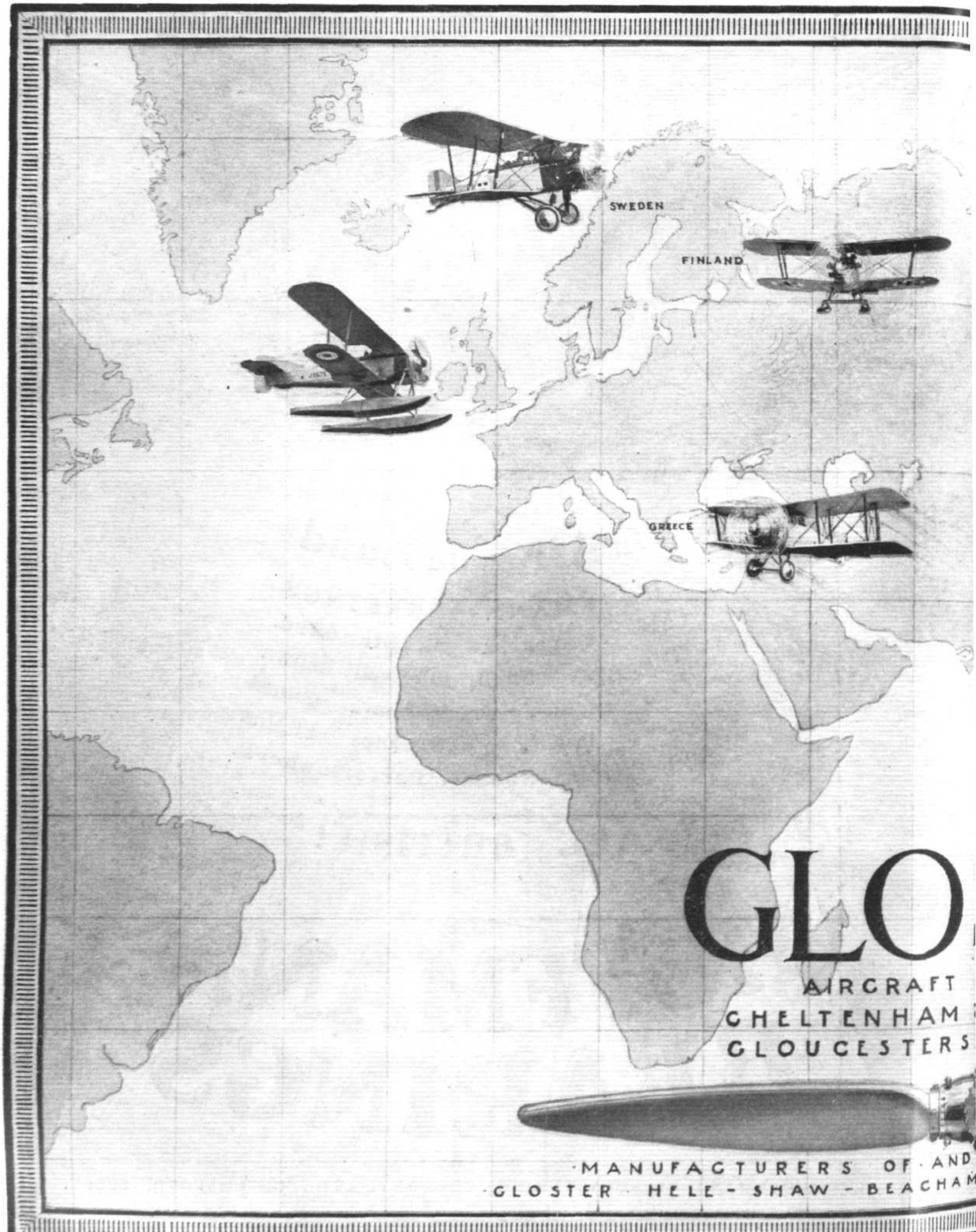
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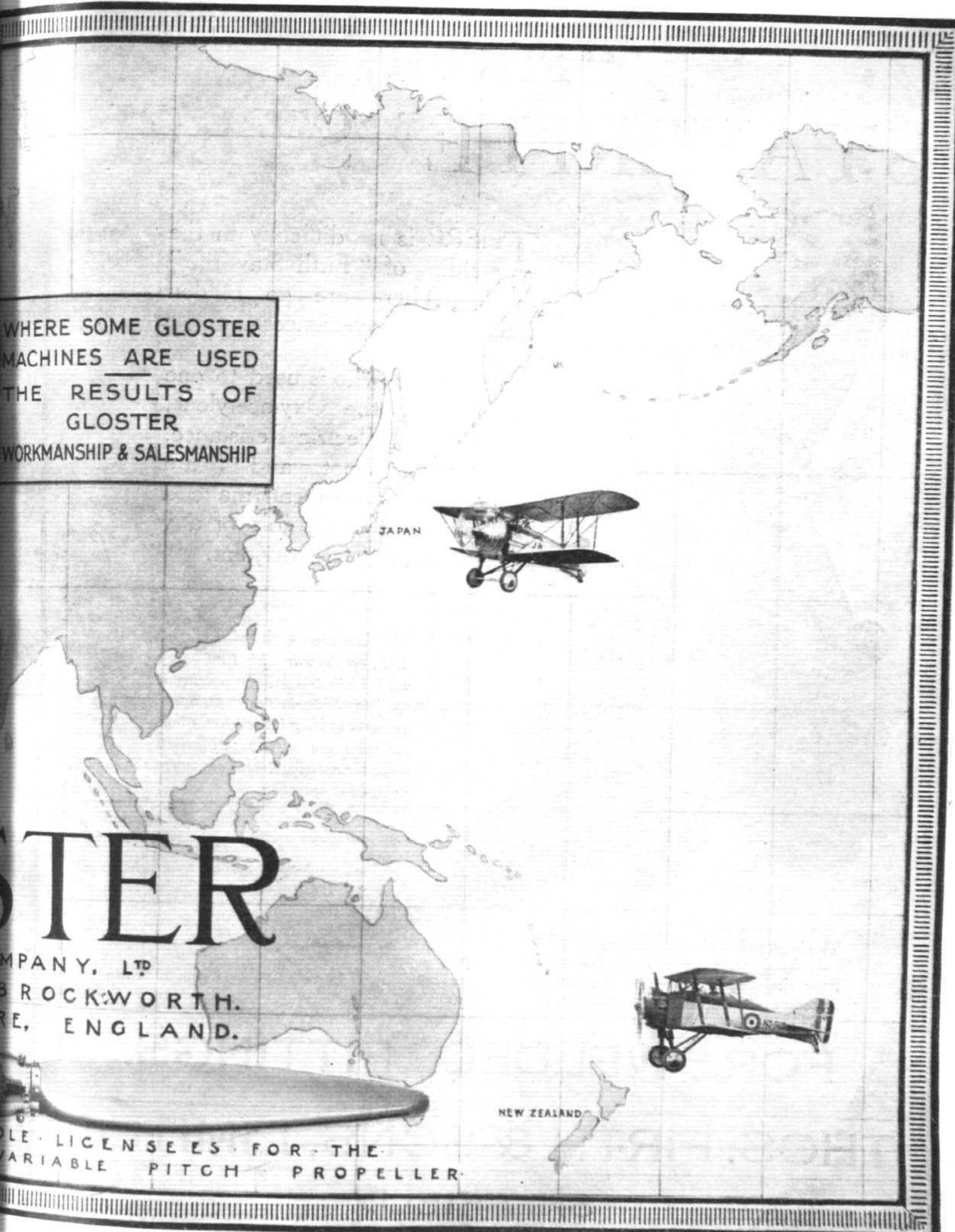

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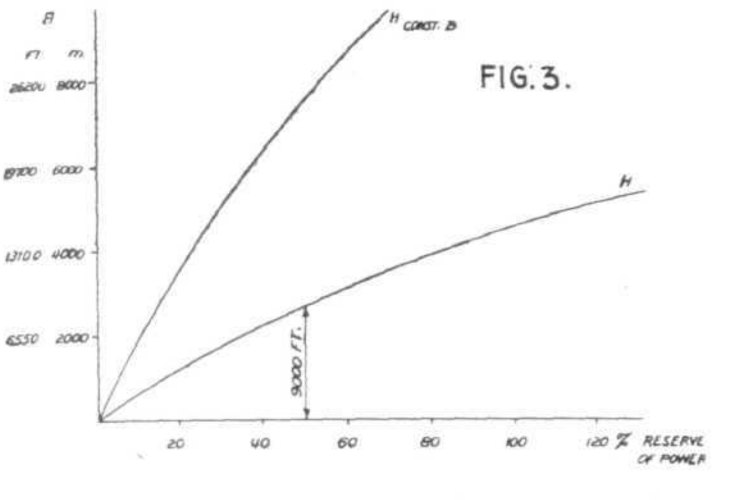
of low landing speed. A small aspect ratio reduces parasite resistances and facilitates very light and strong construction of the wings.

Rectangle III (shown in dotted lines) gives the relation for the aspect ratio 6 and the same values of drag coefficients.

The lift coefficient will be $C_L = 0 \cdot 835$, so that for the same landing speed the cruising speed will be only 84 m.p.h. The wing loading remains 15·15 lb. per sq. ft., and at the same propeller efficiency (75 per cent.) the power loading will be 37·9 lb. per h.p. The cruising radius will increase to 4,350 miles.

For the higher aspect ratio the cruising radius increases with decreasing speed. If we want a higher speed there is no reason for a higher aspect ratio.



The theoretical landing speed at full load is still high; during the flight it decreases with the decreasing load of fuel (for a distance of 1,800 miles it will be 57 m.p.h. only). For the case of a forced landing at the start of the flight with full load it would be necessary to use slotted or variable-camber wings. On a flying field the wheel brakes can be used, or, finally, the fuel can be discharged.

The values of L_W and L_B are already limited by the condition of flying at the best angle of incidence. If there is no reserve power (that is, if this power corresponds to the values from Fig. 2) the theoretical ceiling of the plane at the start of flight will be about 2,600 ft. (it corresponds to the flight at the angle of minimum power, which is approximately 87 per cent. of the power when flying at the angle of minimum resistance) and the absolute ceiling will be 0. This corresponds to the angle of minimum resistance; the aeroplane cannot take off.

The calculation of the ceiling* is as follows:

The formula for lift at an altitude h m. above the sea-level is

$$W = \frac{p_h}{2g} \cdot C_L \cdot A \cdot Vh^2 \qquad \ldots\ldots (10)$$

The formula for drag at an altitude h m. above the sea-level is taken from equation (3),

$$D_h = \frac{75 \cdot B_h \cdot \epsilon}{V_h} = \frac{p_h}{2g} \cdot 2C_{D\ prof} \cdot \phi \cdot A \cdot V_h{}^2 \qquad \ldots\ldots (11)$$

We assume that the power decreases proportionally with the density of air in different altitudes, or

$$B_h = B_0 \cdot \frac{p_h}{p_0} \qquad \ldots\ldots (12)$$

and the variation of the density of air with altitude as in the French standard atmosphere (S.T.Ae.), or

$$\frac{p_h}{p_0} = \left(\frac{288 - 0.0065\,h}{288}\right)^{4\cdot256} \qquad \ldots\ldots (13)$$

* The calculation of the ceiling is based on the French formula of the standard atmosphere (S.T.Aé.), which is most advantageously adapted to this. The difference in American and French standards is not of sufficient importance to be considered in the present case.

From equations (10), (11), (12) and (13), and by using the values L_W and L_B, we find the altitude

$$h = \frac{288}{0.0065}\left[1 - \left(\frac{2g}{p_0} \cdot \frac{1}{75^2} \cdot \frac{(2C_{D\ prof} \cdot \phi)^2}{C_L{}^3} \cdot \frac{L_W \cdot L_B{}^2}{\epsilon^2}\right)^{\frac{1}{12\cdot768}}\right]$$

The theoretical ceiling for a given aeroplane will be at the minimum value of $\frac{(2C_{D\ prof} \cdot \phi)^2}{C_L{}^3}$, or

$$H_{th} = 44{,}300\left[1 - \left(\frac{2g}{p_0} \cdot \frac{1}{75^2}\left\{\frac{(2C_{D\ prof} \cdot \phi)^2}{C_L{}^3}\right\}_{min} \cdot \frac{L_W \cdot L_B{}^2}{\epsilon^2}\right)^{\frac{1}{12\cdot768}}\right] \qquad \ldots\ldots (14)$$

If we substitute in (14) the values given in equations (3), (7a), (7b), (8), and (9), (where $\frac{(2C_{D\ prof} \cdot \phi)^2}{C_L{}^3}$ is not yet a minimum), we find the absolute ceiling, which is

$$H = 44{,}300\left[1 - (1)^{\frac{1}{12\cdot768}}\right] = 0$$

For a supercharged engine, whose output remains constant with the altitude, the theoretical ceiling is

$$H_{th\ \cdot\ const\ B} = 44{,}300\left[1 - \left(\frac{2g}{p_0} \cdot \frac{1}{75^2}\left\{\frac{(2C_{D\ prof} \cdot \phi)^2}{C_L{}^3}\right\}_{min} \cdot \frac{L_W \cdot L_B{}^2}{\epsilon^2}\right)^{\frac{1}{4\cdot256}}\right] \qquad \ldots\ldots (15)$$

Fig. 3 shows the values of the absolute ceiling for different reserve powers.

For a surplus of 50 per cent. of the power, adopted in our theory, the absolute ceiling at the start of the flight is

$$H = 44{,}300\left[1 - \left(\frac{1^2}{1.5^2}\right)^{\frac{1}{12\cdot768}}\right] = 2{,}730 \text{ m. } (9{,}000 \text{ ft.})$$

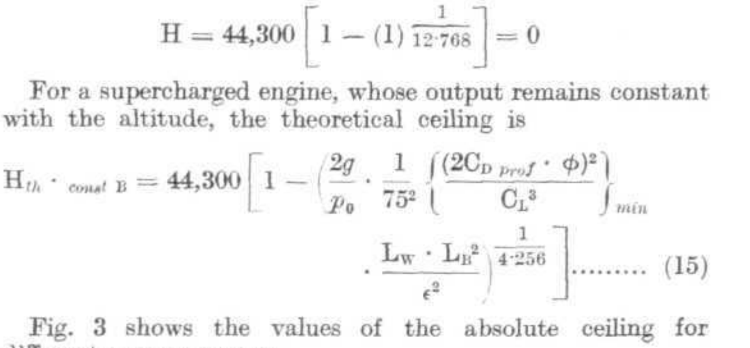


Fig. 4 gives the relation between the initial power loading, at the different reserve powers, and the percentage of the fuel weight to the total weight, at the different construction weights of the planes in relation to the wing loadings.

We assume that for a wing loading of 8 lb. per sq. ft. the structural weight is about 33 per cent. of the total weight. For a wing loading of 24 lb. per sq. ft. we find the structural weight is only 25 per cent. of the total weight. We also assume that the wing loading of 24 lb. per sq. ft. corresponds to a power loading of about 9 lb. per h.p., and for a wing loading of 8 lb. per sq. ft. a power loading of about 32 lb. per h.p.

The useful load (or fuel load) is determined for the surpluses of 0, 50 and 100 per cent. of the power, assuming an engine weight of 3 lb. per h.p.

3. The Influence of the Decreasing Weight of Fuel During the Flight.

During a long-distance flight the weight of fuel decreases. In order to fly always in the position of minimum drag the pilot must reduce the speed of the plane, so that the induced drag is the same as the sum of the profile and parasite drag:

$$\frac{2g}{p} \cdot \frac{W^2}{\pi \cdot V^2 \cdot b^2} = \frac{p}{2g} \cdot C_{D\,prof} \cdot \phi \cdot A \cdot V^2 \quad \text{............} \quad (16)$$

If we suppose the flight to be at a constant altitude, then

$$\frac{W}{V^2} = \text{const.}$$

After the time T the weight of fuel consumed will be $W_f = w \cdot W$. The total weight at this time is

$$W_t = W(1 - w) \quad \text{..........} \quad (17)$$

and the speed from equation (16) is

$$V_t = V\sqrt{1 - w} \quad \text{..........} \quad (18)$$

The total drag is

$$D_t = D(1 - w) \quad \text{..........} \quad (19)$$

and the power

$$B_t = B(1 - w)^{3/2} \quad \text{..........} \quad (20)$$

When these conditions are fulfilled at all periods we can reach the maximum cruising radius, and we have the minimum consumption of fuel for all distances, or

$$dW_f = c_s \cdot B_t \cdot dt.$$

Substituting for W_f and B_t we obtain

$$dt = \frac{75 \cdot \epsilon \cdot W}{c_s \cdot D \cdot V \cdot (1 - w)^{3/2}} d(1 - w) \quad \text{..........} \quad (21)$$

The maximum cruising radius will be

$$R = \frac{1}{1{,}000}\int_0^t V_t \cdot dt \quad \text{..........} \quad (22)$$

Substituting for V_t and dt from equations (18) and (21), we find by integration that

$$R = -\frac{1}{1{,}000} \cdot \frac{75 \cdot \epsilon \cdot W}{c_s \cdot D} \log_e (1 - w)$$

assuming a constant efficiency of propeller.

In Section 2 we have already determined the cruising radius at a constant speed as

$$R_{const} = \frac{1}{1{,}000} \cdot \frac{75 \cdot \epsilon \cdot W \cdot w}{c_s \cdot D}$$

whence

$$\frac{R}{R_c} = -\frac{\log_e (1 - w)}{w} \quad \text{..........} \quad (23)$$

By integration of equation (21) between the limits 1 to $(1 - w)$ we obtain the duration of the flight for the distance R, or

$$T = \frac{75 \cdot \epsilon \cdot W}{c_s \cdot D \cdot V} \cdot 2\left(\frac{1}{\sqrt{1 - w}} - 1\right).$$

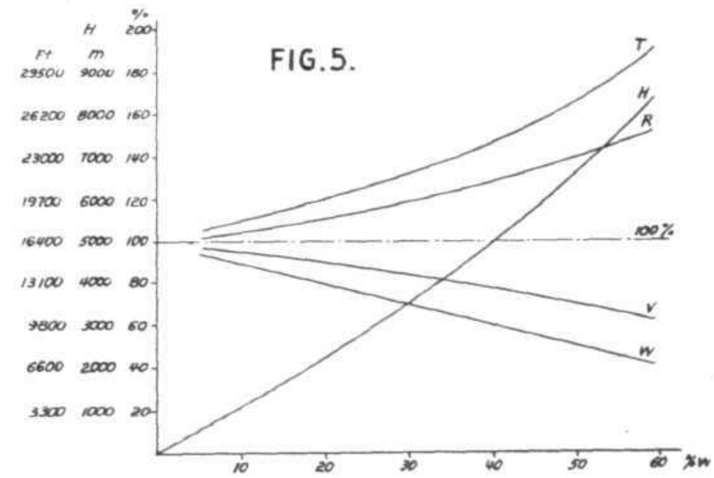
The ratio of this duration to that of Section 2 is

$$\frac{T}{T_c} = \frac{2}{w}\left(\frac{1}{\sqrt{1 - w}} - 1\right) \quad \text{..........} \quad (24)$$

These relations are shown in Fig. 5, as they vary with the value w.

The curve R shows the increase of the maximum cruising radius in percentage as compared with the cruising radius at a constant speed, and also the curves of the duration of flight T and of the speed V. The curve W shows the decrease of the total weight.

For a flight with these conditions the efficiency of the propeller does not change: because the efficiency of the propeller remains constant if its angle of attack (its pitch) does not change; the revolutions of the propeller change with the cube root of power; from equations (18) and (20) the speed changes also in this relation, and so the ratio $\frac{V}{N}$ is constant. The propeller must be adapted for the flight



at the angle of minimum drag in order to obtain the best result.

By flying at a constant altitude we can attain the maximum cruising radius only by reducing the speed. From this a loss results on the cruising radius, due to the greater specific fuel consumption when throttling the engine.

Flying at the higher altitudes, it will be possible to maintain constant speed and the best efficiency.

4. Variation of Long-Distance-Flight Conditions with Altitude.

From the equations of the induced, profile and parasite drag, and from equation (1), it is seen that the condition of flying at the angle of minimum drag obtains also for flight at higher altitudes.

We shall assume that the altitude correction of the carburettor works faultlessly and that the fuel consumption remains the same as at sea-level. This is true, because the increase in the consumption for the altitude will be equivalent to the increase caused by the throttling of the engine at sea-level.

The fundamental equation of the chart of Fig. 2 will change as follows:

$$L_W = \frac{p_h}{2g} \cdot V_h^2 \cdot \sqrt{\pi \cdot \lambda \cdot C_{D\,prof} \cdot \phi}$$

where

$$p_h \cdot V_h^2 = p_0 \cdot V_0^2 = \text{const.} \quad \text{..........} \quad (25)$$

The speed must increase with the altitude inversely as the square root of the air density.

When we substitute for V in equation (8) we obtain

$$W_h \sqrt{\frac{p_h}{p_0}} = \frac{1}{3.6\,L_{B0}} \cdot \frac{R_c \cdot c_s}{w} \quad \text{..........} \quad (26)$$

From equations (10) and (11) we obtain the power loading in flight at the altitude h:

$$L_{Bh} = \frac{C_L}{2C_{D\,prof} \cdot \phi} \cdot 75 \cdot \epsilon \cdot \frac{1}{V_h} \quad \text{..........} \quad (27)$$

or, at a constant propeller efficiency,

$$L_{B0} \cdot V_0 = L_{Bh} \cdot V_h = \text{const.} \quad \text{..........} \quad (28)$$

The power loading is inversely proportional to the velocity and therefore directly proportional to the square root of the air density. The power is directly proportional to the velocity. From equation (26) we find that the cruising radius remains constant for the same specific fuel consumption, and therefore altitude flying shortens the duration of the flight.

The propeller efficiency remains constant if the relation $\frac{V}{N}$ is constant. This is due to the fact that the total resistance from equations (11) and (25) remains constant, and also the propeller thrust:

$$T = \frac{p_h}{p_0} \cdot C_t \cdot N^2 \cdot D^4$$

where C_t is the coefficient of the type of propeller and D is the diameter.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"AS an instance of the way in which the REYNOLDS TUBE COMPANY has developed its Aircraft Section, it may be mentioned that two years ago Aircraft Tubing constituted but 5% of the firm's total output. During the last three months this percentage has risen to 40%."
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The revolutions increase inversely as the square roots of the air densities, the same as the velocity. This must be provided for by reserve power.

5. The Influence of the Decreasing Load of Fuel on the Al titude of Flight.

This forms a mutual relation of both preceding sections. We have seen in Section 3 that the cruising radius can be increased by decreasing the speed. According to Section 4, by flying at higher altitudes with the same cruising radius we can shorten the duration of flight. Therefore, both advantages can be obtained by also fulfilling the conditions of equation (16) for the altitude, or

$$\frac{W}{p \cdot V^2} = \text{const.} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (29)$$

To keep a constant initial speed we must fly at an altitude determined from this equation. Reduction of fuel corresponds to a certain ratio of air densities, namely,

$$\frac{p}{p_0} = 1 - w \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (30)$$

which, according to equation (13), gives the altitude

$$H = 44{,}300\,[1 - (1 - w)^{0 \cdot 235}] \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (31)$$

which is drawn in Fig. 5 as curve H.

The power loading remaining constant, the power has to be decreased proportionally with the weight.

This proves that Fig. 2 is correct for the large values of cruising radius.

IN THE DRAWING OFFICE.

NOMOGRAPHY AND DESIGN DATA.

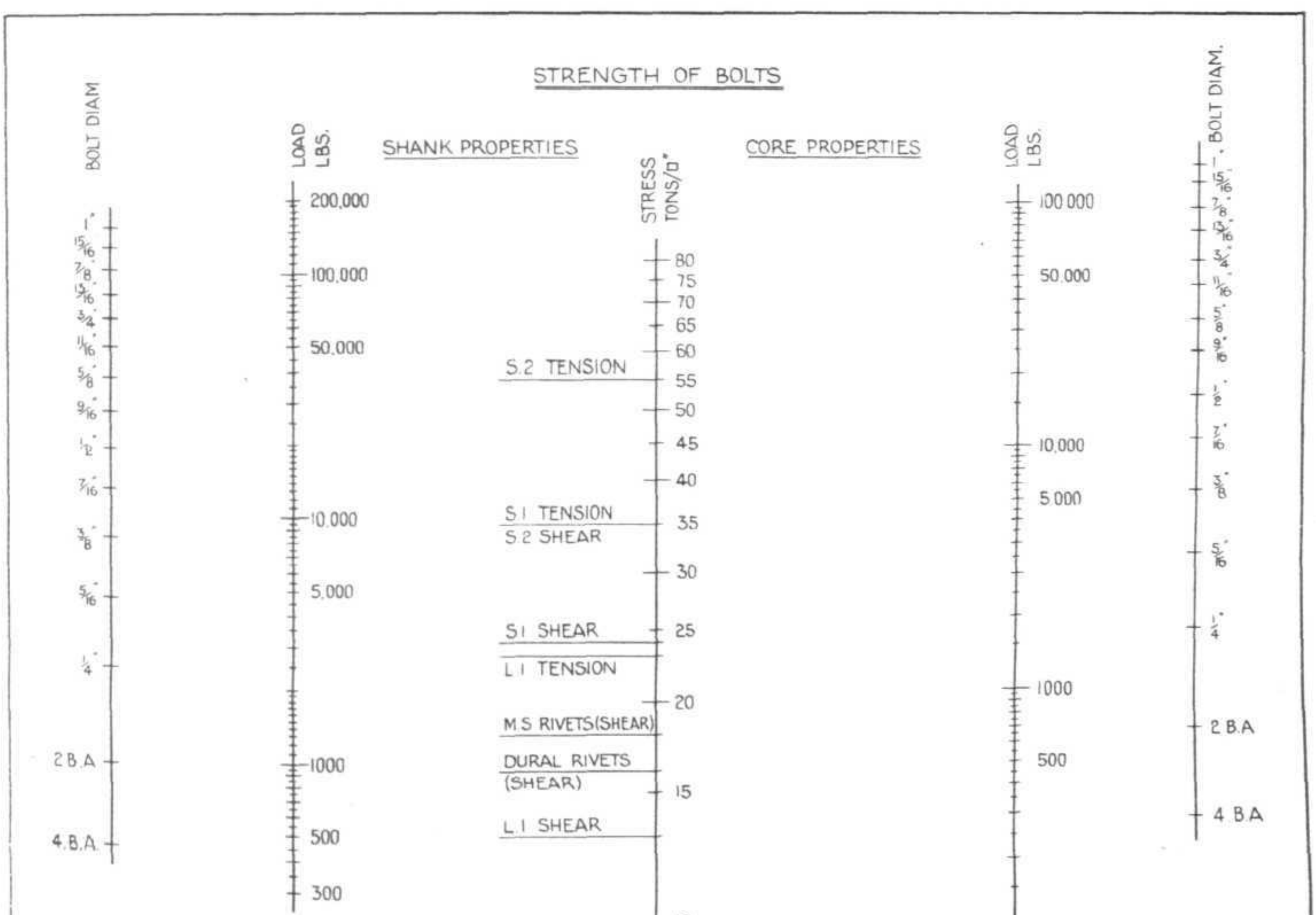
By ROBERT RODGER

In THE AIRCRAFT ENGINEER recently, Mr. H. Parkinson described a method of dealing concisely with detail design data to meet variables in bolt size, quality of material, and conditions of loading. He adopted the method employing a master table in conjunction with suitable correction factors, such a method involving the use of both a table and a slide rule.

The data may, in the opinion of the writer, be presented in a more self-contained manner by means of the nomogram, or alignment chart as it is sometimes styled. Admittedly, for the data under consideration, two nomograms are required; one being for tension and shear, and the other for bearing, but in either case the only operation necessary is the laying of a straight-edge across two plotted scales, thus connecting two of the variables, the corresponding third variable being read off *directly* at the intersection of the straight-edge with the third and, in this particular case, intermediate scale.

The double nomogram herewith connects bolt diameter, strength of material, tension and shear on the core, and tension and shear on the shank, all on the one sheet. The degree of accuracy associated with a nomogram is insufficient for certain special calculations, *e.g.*, astronomical, but for aircraft detail design it should be all sufficing. Even, however, in the case of calculations of a more exacting nature, the nomogram will frequently be found valuable, both as a means of rapid approximation upon which to assess possibilities, and also as a check on errors in elaborate calculations involving routine work of a tedious nature.

As an illustration of the degree of accuracy which one



might expect, take the three examples quoted by Mr. Parkinson, viz., a $\frac{1}{2}$-in. diameter bolt in material having $f_t = 30$ tons/sq. in. and $f_s = 25$ tons/sq. in., and a $\frac{3}{8}$-in. diameter bolt in material having $f_t = 55$ tons/sq. in. The results as found from the table are quoted as 13,194 lbs., 10,995 lbs., and 13,607 lbs. The corresponding values as deduced from the nomogram are 13,250 lbs., 11,000 lbs., and 13,750 lbs. respectively. This gives an error of the order of 1 per cent. in the worst case, which should satisfy the most fastidious of detail designers engaged on aircraft work.

Although the nomogram is by no means a new method of plotting data it is, in the experience of the writer, regarded by the majority of aircraft draughtsmen as a mysterious affair requiring a highly developed mathematical knowledge for its construction. This is not a fact, and the attitude towards the nomogram is all the more peculiar, bearing in mind the general average facility with which draughtsmen manipulate the slide rule. Perhaps, under these circumstances it would not be out of place here to add a few general remarks on nomography, and to describe, in some detail, the construction of the nomogram accompanying these notes.

Nomography was first introduced into this country by Lieut.-Col. R. K. Hezlet, R.A., in 1910, and three years later he presented a short treatise on the subject, which was published by the Royal Artillery Institution, Woolwich. For those readers who may evidence any further interest in the subject one can recommend a study of the text-book "Line Charts for Engineers," by Rose, and the pamphlet "Logarithmic Scales," by Newby, the latter issued by the Association of Engineering and Shipbuilding Draughtsmen.

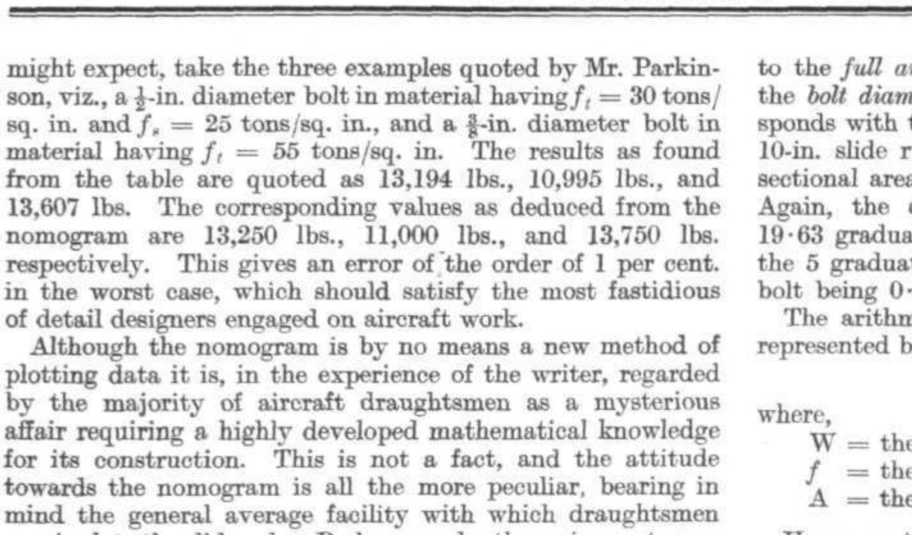


FIG. 1. FIG. 2.

Only one side of the nomogram herewith, that referring to shank properties, will be considered, as this diagram virtually consists of two nomograms—one on each side of the stress scale—the principles involved being the same for both sides.

First it is necessary, from a knowledge of the variables which we wish to connect, to plan the layout of the nomogram, and this we must do with an eye to compactness and facility of operation. It is generally, but not necessarily so, an aid to operation to arrange for the scale for the derived quantity to lie between the two scales for the given quantities. In the case under consideration then, the load scale is embraced by the stress scale and the bolt diameter scale. The spacing of these two latter scales is also a matter of choice and convenience, and their graduation is logarithmic, being taken direct from an ordinary standard 10-in. slide rule.

The stress scale is based on a 10-in. logarithmic scale and bears a direct notation, *i.e.*, the graduation marked 40 tons/sq. in. corresponds with the 4 graduation on scale D of the standard 10-in. slide rule, 80 tons/sq. in. with the 8 graduation, 15 tons/sq. in. with the 1·5 graduation, and so on. The bolt diameter scale is based on a 5-in. logarithmic scale and bears an indirect notation. It is *graduated* according to the *full area* of the bolt, but the *notation* is referred to the *bolt diameter*. Hence, the division marked $\frac{1}{4}$ in. corresponds with the 4·91 graduation on scale A of the standard 10-in. slide rule and not with the 2·5 graduation, the full sectional area of a $\frac{1}{4}$-in. diameter bolt being 0·0491 sq. ins. Again, the division marked $\frac{1}{2}$ in. corresponds with the 19·63 graduation on scale A of the slide rule and not with the 5 graduation, the full sectional area of a $\frac{1}{2}$-in. diameter bolt being 0·1963 sq. in. And so on.

The arithmetical operation which we wish to perform is represented by the formula

$$W = 2240 f A$$

where,

W = the failing load of the bolt, in lbs.
f = the stress, in tons/sq. in.
A = the cross-sectional area of the bolt in sq. ins.

However, the basic data given are usually the stress and the bolt diameter, hence, in *constructing* the nomogram we must use sectional area, but in *using* the nomogram we employ bolt diameter. This accounts for the apparent complication in the bolt diameter scale.

We now have to determine both the position and the graduation of the support, *i.e.*, the load scale.

First the position. This is fixed by what are known as the upper and lower datum points. Briefly, we have to determine two combinations of f and A giving a *low* value of W, and two other combinations giving a *high* value. Thus,

(i) $\frac{3}{4}$-in. diam. with 10 tons/sq. in. gives W = 9,900 lbs.

(ii) $\frac{1}{4}$-in. diam. with W = 9,900 lbs. gives f = 90 tons/sq. in.

and

(iii) 1-in. diam. with 40 tons/sq. in. gives W=70,368 lbs.

(iv) $\frac{7}{8}$-in. diam. with W = 70,368 lbs. gives f = 71·11 tons. sq. in.

The lower datum point is defined by (i) and (ii), and the upper datum point by (iii) and (iv). The application is illustrated in Fig. 1.

Actually it is sufficient to calculate one datum point only because it is proved mathematically that formulæ of the nature of the one with which we are dealing give nomograms comprising three parallel rectilinear scales. It would be in order, therefore, to determine one datum point and draw through it a straight line parallel to the other two scales. The determination of the second datum point, however, provides a useful check at this stage on the graduation of the other two scales, as any error therein will result in a support which is non-parallel.

Now for graduation. It is required to fix two values on the load scale giving a reasonable range. It would be in order to use the two datum points previously calculated, but personally one prefers to use round figures. Taking the stress at 35 tons/sq. in., then, a 2 B.A. bolt will carry 2,100 lbs., and a $\frac{5}{8}$ bolt will carry 24,000 lbs. These two points are determined on the load scale, and their intercept thereon is referred to a master logarithmic scale to obtain the entire graduation of the load scale.

This is accomplished as follows. Lay out from the slide rule the master scale, see Fig. 2, and at some convenient distance from it, and parallel to it, draw a straight line as a support to bear the load scale. Transfer to any convenient position on this support the intercept from the nomogram, as previously determined. Connect, by straight lines, the limits of this intercept with the corresponding values on the master scale, and extend these lines beyond the support until they intersect in the origin O. Straight lines drawn between the master scale and this origin will cut the support in a number of points, thus giving the appropriate reduction of the master logarithmic scale. This can finally be transferred to the load support of the nomogram.

The procedure for the right-hand side of the nomogram *i.e.*, core properties, is similar except that, of course, the core sectional area of the bolt is used instead of the full sectional area.

TECHNICAL LITERATURE

SUMMARIES OF AERONAUTICAL RESEARCH COMMITTEE REPORTS

These Reports are published by His Majesty's Stationery Office, London, and may be purchased directly from H.M. Stationery Office at the following addresses: Adastral House, Kingsway, W.C. 2; 28, Abingdon Street, London, S.W.1; York Street, Manchester; 1, St. Andrew's Crescent, Cardiff; or 120, George Street, Edinburgh; or through any bookseller.

Wind-Tunnel Experiments on the Design of an Automatic Slot for R.A.F. 28 Section, and on Interconnection with Ailerons. By F. B. Bradfield, Math. and Nat. Sci. Triposes, and K. W. Clark, B.Sc., D.I.C. Presented by the Director of Scientific Research, Air Ministry. R & M. No. 1165 (Ae. 329). (20 pages and 14 diagrams.) April, 1928. Price 1*s*. net.

The investigation arose in connection with fitting an autoslot system to the "Atlas," and includes the development of a system of interconnecting the slot with the ailerons.

The free settings and lift have been measured for a 12 per cent. auxiliary on a wing of R.A.F. 28 section, with a wide range of variation of linkages, and the drag and centre of pressure of the slotted wing were measured in some cases. Rolling and yawing moments have been measured for two linkages for the autoslot, and for the interconnected autoslot and ailerons. The forces necessary to work the interconnection have been determined, and the force on the auxiliary aerofoil measured.

The maximum lift coefficient obtained was 0·75, the stall on the slotted tip being delayed to about 9° greater incidence. The simple autoslot improves the aileron control somewhat by increasing the rolling moment, but the ratio of yawing moment to rolling moment is not much altered. By interconnecting the slot with the ailerons, a greater increase of rolling moment is obtained, and the sign of the yawing moment can be reversed at and over the stall, as in previous slot and aileron control systems. The automatic character of the slot is unaltered when the ailerons are neutral; and the additional force on the control column can be kept small.

Full-scale tests of this slot are proceeding.

The Distribution of Pressure over the Hull and Fins of a Model of the Rigid Airship R.101, and a Determination of the Hinge Moments on the Control Surfaces. By Dr. R. Jones, M.A., and A. H. Bell. R. & M. No. 1169. (Ae. 333). (37 pages and 13 diagrams). July, 1927. Price 1*s*. 9*d*. net.

The work described in this report and in R. & M. 1168 was conducted at the request of the Royal Airship Works, Bedford, in connection with the design of the airship R. 101.

The following were the measurements made on the particular model tested:—

(i) Distribution of pressure over the hull (circular section). No fins.
(ii) Distribution of presure over the fins and control surfaces (fins 2 of R. & M. 1168*).
(iii) Hinge moments on the control surfaces as used in (ii) and on modified forms.
(iv) The magnitude and direction of the wind speed near the hull.

The pressure on hull, fins and control surfaces have been integrated and compared with balance measurements. The comparisons are in accord with previous experience. Inclining the rudders appreciably affects the pressure on the fixed fins well in front of the hinge.

The rudders are underbalanced over the greater part of the range considered, but there is a range of angle over which there is considerable overbalance. Hinge moment coefficients are less than on a type previously examined even though the balancing area is less. This refers to underbalancing.

The fall of wind speed is very rapid in the immediate neighbourhood of the hull; the rate of the change in speed decreases towards the after end of the model.

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* Experiments on a model of the Airship R. 101. Jones and Bell. R. & M. 1168 may be regarded as Part I of the work on R.101, the present report being Part II.

Report of the Airworthiness of Semi-Rigid Airships Sub-Committee. R. & M. No. 1170. (Ae. 334.) (15 pages and 1 diagram.) November, 1928. Price 9*d*. net.

The general considerations affecting the airworthiness of non-rigid and semi-rigid airships under a number of flight conditions and the methods of calculation or estimation of stresses in the various parts of the ship are discussed. In the opinion of the Sub-Committee the only satisfactory method of determining the internal pressure necessary to maintain the shape of these types of airship is to test a scale model inverted and filled with water. The method of using the water model to find the pressure loading on the actual airship is described and a method of calculating the fabric tensions at all points is outlined (see Appendix). A factor of safety of 4 is recommended for the breaking tension of the fabric based on a quick-break test, this factor being the ratio of such tension divided by the greatest tension which it is calculated the fabric is called upon to withstand. Rigging attachments are required to have the same factor of 4, but for some purposes a factor of 3 only is required.

Mention is made of performance requirements according to the duty for which the airship is designed, of the proper use of gas valves and ballonets, of the carrying of ballast, of stability and control, of wireless equipment, of protection from electrical discharges and of fire prevention measures. Included at the end of the report is a bibliography of a number of reports and published papers to which the Sub-Committee have referred or used in the preparation of their report.

The Theoretical Relationships for an Aerofoil with a Multiply Hinged Flap System. By W. G. A. Perring, R.N.C., A.M.I.N.A. Presented by the Director of Scientific Research, Air Ministry. R. & M. No. 1171. (Ae. 335). (14 pages and 5 diagrams). April, 1928. Price 9*d*. net.

Theoretical expressions for the lift and pitching moment of an aerofoil in two dimensional motion were developed in R. & M. 910.* This theory was extended in R. & M. 1095,† to include the hinge moment of a flap in the case of a rectangular aerofoil of finite span.

The analysis has now been extended to an aerofoil fitted with a multiply-hinged flap system, and theoretical expressions for lift and pitching moment of the aerofoil, and the hinge moment about any hinge position have been deduced in the case of a rectangular aerofoil of finite span. Application of the theoretical expressions to the particular case of an aerofoil fitted with a servo-operated flap is considered, and the theory compared with experiment.

The agreement between theory and experiment is found to be very satisfactory in the case of a flap 0·3 of the aerofoil chord, but ceases to be as good when the flap or servo chord becomes very small.

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* R. & M. 910. A theory of thin aerofoils. By H. Glauert.
† R. & M. 1095. Theoretical relationships for an aerofoil with hinged flap. By H. Glauert.

Full Scale Determination of the Effect of High Tip Speeds on the Performance of an Airscrew. By W. G. Jennings, B.Sc. Presented by the Director of Scientific Research, Air Ministry. R. & M. No. 1173. (Ae. 337.) (10 pages and 8 diagrams.) August, 1928. Price 9*d*. net.

This report describes a full-scale investigation which had for its object the determination of how far conclusions arrived at from model results as to the effect of high tip speeds on the performance of an airscrew are applicable to full-size airscrews in free flight.

The aircraft used for the experiments was a Fairey "Fox" fitted with a Curtiss D.12 engine. The engine was calibrated on the test bed at two positions of the throttle and flight tests were carried out at heights of 3,000, 5,000 and 15,000 feet in order to determine the tip speed effect on the torque and thrust coefficients of the airscrew.

Wind tunnel tests on a model of a similar airscrew are analysed and the results compared with the full-scale tests.

The comparison of the full-scale with the model results shows that there is a considerable scale effect (due to difference in size) at high tip speeds and that the conclusions arrived at from model tests may not be applicable to full-scale airscrews in free flight.

Wind Tunnel Tests with High Tip Speed Airscrews. Some Experiments upon an Airscrew of Conventional Blade Section, Aerofoil R. and M. 322, No. 3, at High Speeds. By G. P. Douglas, D.Sc., and W. G. A. Perring, R.N.C. Presented by the Director of Scientific Research, Air Ministry. R. & M. No. 1174. (Ae. 338.) (8 pages and 4 diagrams.) July, 1928. Price 9*d*. net.

The present experiments continue the investigation into the effect of tip speed on airscrew performance, described in R. & M. Nos. 1086*, 1091†, and 1124‡. The tests have been made to extend the results of R. & M. 1124, on the conventional airscrew section R. & M. 322, No. 3, to higher Reynolds' numbers.

A variable pitch airscrew having a conventional type of blade section has been tested under the same conditions as the airscrews described in the previous reports, but the present airscrew had a constant chord width of 2 in. It had a blade section of maximum thickness 10 per cent. of the chord, the section being similar to that tested and described in R. & M. 1124. The thrust and torque gradings have been measured at two pitch settings for tip speeds up to 1·15 times the velocity of sound, and the results have been analysed to show the variation of lift and drag with speed.

The analysis of the tests does not produce consistent lift curves at low speeds and this apparent failure of the airscrew theory detracts from the value of the experiment as a test of the influence of Reynolds' number at high speed, which should rather be investigated by using tapered airscrews of larger scale. Some full scale tests are proceeding.

It seems reasonable, however, to infer from this experiment that Reynolds' number is an important factor, and that the transition from "low speed", to "high speed" types of flow is delayed by increasing the scale.

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* R. & M. 1086.—Wind tunnel tests with high speed airscrews. The characteristics of the aerofoil section R.A.F.31A at high speeds.—G. P. Douglas and W. G. A. Perring.
† R. & M. 1091.—Wind tunnel tests with high tip speed airscrews. The characteristics of a bi-convex aerofoil at high speeds. Douglas and Perring.
‡ R. & M. 1124.—Wind tunnel tests with high tip speed airscrews. The characteristics of a conventional airscrew section, aerofoil R. & M. 322, No. 3, at high speeds.—Douglas and Perring.

AN ANALYSIS OF A RECTANGULAR MONOPLANE WITH HINGED TIPS. By S. B. Gates, M.A. Presented by the Director of Scientific Research, Air Ministry. R. & M. No. 1175. (Ae. 339.) (10 pages and 4 diagrams.) January, 1928. Price 1s. net.

A method of analysis is suggested which is capable of giving a fair approximation to the characteristics of an aerofoil of irregular plan form or abruptly changing incidence. Earlier work on a similar problem has been published as R. & M. 1095* and 1171.†

This is applied to the problem of a rectangular monoplane of aspect ratio 6, of which the outer third of each semi-span is at a different incidence from the main portion. The variation of load and of induced velocity along the span is calculated, and expressions are obtained for the lift coefficients of the separate members of the combination.

It is found that the slope of the lift curve of the outer portion, regarded as separately movable, is 14 per cent. greater than if the outer portion were an isolated aerofoil, and 33 per cent. less than if it were rigidly attached to the wing.

It is suggested that the results may be used as a first approximation to a design in which the tips of a swept back wing are used to give longitudinal control, as in the Pterodactyl.

* R. & M. 1095. Theoretical relationships for an aerofoil with hinged flap.—H. Glauert.

† R. & M. 1171. The theoretical relationships for an aerofoil with a multiply hinged flap system.—W. G. A. Perring.

A BRIEF SURVEY OF WING FLUTTER WITH AN ABSTRACT OF DESIGN RECOMMENDATIONS. By R. A. Frazer, B.A., B.Sc., and W. J. Duncan, B.Sc., A.M.I.Mech.E. R. & M. No. 1177 (Ae. 341). (31 pages). October, 1928. Price 1s. 3d. net.

The Accidents Investigation Sub-Committee have previously drawn attention, in R. & M. 1041* to a number of occurrences of wing flutter. They recommended that the vibration of aeroplane structures should be studied, both from the theoretical and the experimental standpoints, with a view to the discovery of methods for the avoidance of flutter. A full account of the investigations carried out at the National Physical Laboratory in accordance with this recommendation is given elsewhere in the Monograph, R. & M. 1155.† The present report, which is in two parts, provides a short non-mathematical treatment of the subject. Part I surveys the theoretical principles underlying the investigation, and concludes with a list of design recommendations which are severally discussed. Experimental tests of certain of these recommendations are recorded in Part II. An annotated bibliography of papers on wing flutter and cognate subjects is given in the Appendix.

GROUP I.—*Recommendations relative to ailerons.*

(*a*) Irreversibility of aileron control.‡

Failing (*a*)

(*b*) Centre of gravity of aileron slightly ahead of hinge.

(*c*) Moment of inertia of the aileron small.

(*d*) An appreciable part, preferably rather more than one-half of the aileron should lie inboard of the centre line of the attachments of the outermost external wing bracing.

(*e*) Aileron heavily damped, *e.g.*, artificially.

(*f*) Aileron definitely underbalanced aerodynamically.

GROUP II.—*Recommendations relative to wing structures. (With special reference to overhangs.)*

(*g*) Balance of masses of each overhang§ (including corresponding portion of aileron) about its flexural axis.

(*h*) Flexural axis close to its axis of independence.||

(*j*) All elastic stiffnesses as large as possible.

* R. & M. 1041. Accidents to aeroplanes involving flutter of the wings. Report of the Accidents Investigation Sub-Committee.

† R. & M. 1155. The flutter of aeroplane wings.—Frazer and Duncan.

‡ This recommendation is due to Mr. R. V. Southwell, F.R.S.

§ The term overhang will be understood to mean that portion of each wing which extends beyond its outermost external bracing.

|| For definition and remarks on the flexural axis, see § 6 (*b*).

THE CHANGE IN AIRSCREW CHARACTERISTICS WITH HEIGHT. By A. E. Woodward Nutt, B.A., of the Aeroplane and Armament Experimental Establishment, Martlesham Heath. Communicated by the Director of Scientific Research, Air Ministry. R. & M. 1178. (Ae. 342). (10 pages and 3 diagrams.) August, 1928. Price 9d. net.

A request was received in the summer of 1927 to investigate how the applicability of the research method of performance testing was affected by change in the characteristics of the airscrew of an aircraft with height. In the latter part of the year this method of testing was superseded by the combined method of R. & M. 1140,* in the course of which the effect of change in the airscrew characteristics if present, is shown up, and can be allowed for in the reduction. The investigation was accordingly extended to cover the application of this method in addition.

The results of tests on two single-seater aircraft for which there was evidence of change in the airscrew characteristics between ground level and their ceilings are analysed and the variation of airscrew thrust and torque coefficients with height investigated. An attempt has been made to determine the factors responsible for the observed change in the airscrew characteristics, and to investigate to what extent the results of flight tests may be applied to separate the effects of these factors.

The report is usefully summarised by the author as follows :—

(1) Considerable change in the characteristics of an airscrew may take place between ground level and the ceiling of the aircraft to which it is fitted.

(2) The change with height of the airscrew thrust and torque coefficients at any particular value of V/nD can be determined.

(3) The factors which cause change in the characteristics of an airscrew with height are the twisting of the blades due to the resultant of the centrifugal and aerodynamic loads, and the change in the characteristics of the blade sections due to the compressibility of the air and scale effect.

(4) Complete separation of these effects is not possible by flight tests of the type considered, and it appears that in the tests analysed in this report any effect observed on the torque coefficient curve is due either to air loads on the blades or to scale effect or both, while any effect observed on the thrust coefficient curve is due to air compressibility or centrifugal loads or both. If the twist of the airscrew blades and its effects can be calculated theoretically, the compressibility effect on the thrust coefficient and the scale effect on the torque coefficient are determined by the tests.

(5) The applicability of the combined method of performance testing is to a close approximation unaffected by change in the airscrew characteristics.

* R. & M. 1140. Notes on Performance Testing by H. L. Stevens and A. E. Woodward Nutt.

ROLLING EXPERIMENTS ON AN AEROFOIL OF R.A.F. F.32 SECTION. By H. B. Irving, B.Sc., and A. S. Batson, B.Sc. R. & M. No. 1182 (Ae. 346). (8 pages and 6 diagrams) September, 1928. Price 6d. net.

In an unpublished paper H. M. Garner shows from a consideration of aerofoil theory and of certain full-scale results that increasing the thickness of an aerofoil may be expected to lead to a reduction or change of sign of the yawing moment (body axis) due to rolling near the stall and consequently to an improvement in the lateral control at low speeds. For, as is there pointed out, it is the (usually) large positive value of the N_p of the wings near stalling incidence which necessitates a large rudder power, quite apart from that which may be required to overcome any yawing moment due to ailerons.

Measurements were made of rolling and yawing moments on a 6-in. by 36-in. aerofoil of R.A.F. 32 section (thick, see Fig. 1) due to rolling about the wind axis. Comparing the results obtained with similar ones for R.A.F.15* section, Mr. Garner's theorem appears to apply in this case over a range of incidence of from about 3° before the stall to 4° after the stall. At higher incidences, however, both the yawing and (unstable) rolling moments are considerably higher for R.A.F.32 than for R.A.F.15 and it is doubtful whether there is any resultant advantage gained.

* R. & M. 1064. The effects of stagger and gap on the aerodynamic properties of biplanes at large angles of incidence. Parts I and II.—Irving, Batson and Burge.

R. & M. 1006. Full scale and model measurements of lift and drag of Bristol Fighter with R.A.F. 32 wings.—Anderson and Caygill.

EXPERIMENTS ON A MODEL OF A SINGLE SEATER FIGHTER AEROPLANE IN CONNECTION WITH SPINNING. By H. B. Irving, B.Sc., and A. S. Batson, B.Sc. R. & M. No. 1184. (Ae. 347). (21 pages and 14 diagrams). May, 1928. Price 1s. net.

The inquiry was made to investigate generally the behaviour of the tail members of the aeroplane in a spin at high incidence and to determine whether a simple yaw experiment might give a sufficiently near approximation to the moments due to fin and rudder in a spin and thus provide a simple criterion for safety in spinning.

Measurement of pitching moment on a $\frac{1}{10}$th scale model with and without tailplane (tailplane settings $-33\cdot5°$ and $+4\cdot25°$) was made over an incidence range from 0° to 70° (*a*) with normal body, (*b*) with lengthened body.

Measurement of rolling moment at rates of roll was also made up to about $ps/V = 0\cdot9$ with rudder settings 0° and $\pm 33°$ and without fin and rudder, (*a*) with wings, (*b*) without wings. Incidences 30°, 40°, 50 °and 60° approximately (no rudder settings at 30° incidence). Tailplane setting 0°.

Measurements of rolling and yawing moments on the stationary model yawed at angles up to $\pm 35°$ were compared with rolling experiments (model without wings at 50° incidence only) at a tailplane setting of 0°.

So far as pitching moment is concerned, the curves do not show any unusual or unexpected features (Figs. 3–5).

The simple yaw experiment in this particular case generally fails to give any near approximation to the moments due to fin and rudder as found from the rolling experiments (Figs. 13 and 14). This is attributed to the large shielding effect of tailplane on fin and rudder, which effect is apparently sensitive to the interference of the wings on the flow over the tail and is consequently different in the rolling and yaw experiments. It seems probable that the yaw experiments would also be unreliable in giving truly comparative results for different aeroplanes unless the shielding of fin and rudder by tailplane were not great. The attempt, therefore, to find a simple criterion for spinning was not successful.

WIND-TUNNEL TESTS OF VARIOUS SERVO RUDDER SYSTEMS. By K. V. Wright, B.A. Presented by the Director of Scientific Research, Air Ministry. R. & M. No. 1186. (Ae. 348.) (17 pages and 10 diagrams.) March, 1928. Price 1s. net.

In an earlier report, R. & M. 1105,* the aerodynamics of a servo rudder system of the hinged-flap type was analysed using the theoretical formulæ for the lift and moment of an aerofoil with a hinged flap described in another report, R. & M. 1095.† In the present paper, systematic wind-tunnel tests were undertaken on servo rudders in order to check the results of the theoretical investigation, and to provide general data for design. The opportunity was taken to compare a servo rudder system of the hinged-flap type with one of the outrigger type. It was found that the latter type gives slightly higher efficiency and maximum force coefficients than the former. With regard to the agreement with theory in the case of the hinged-flap type, this was found to be reasonably good with a large flap, but the forces and moments due to a smaller flap were considerably less than those predicted. The efficiency of the system, *i.e.*, the ratio of the lift coefficient in the position of equilibrium to that given at the same incidence when the servo is parallel to the main rudder, was, however, slightly higher than that predicted in both cases.

It is proposed to carry out similar work on servo ailerons and elevators.

* R. & M. 1105. The aerodynamics of a simple servo rudder system.—H. M. Garner and C. E. W. Lockyer.

† R. & M. 1095. Theoretical relationships for an aerofoil with hinged flap.—H. Glauert.

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THE ONTARIO PROVINCIAL AIR SERVICE

A Canadian Fire-Fighting Organisation

ONE of the most fully-equipped and well-organised repair and reconditioning plants in North America is that maintained by the Air Service of the Forest Branch of the Ontario Provincial Government at Sault Ste. Marie, Ont.

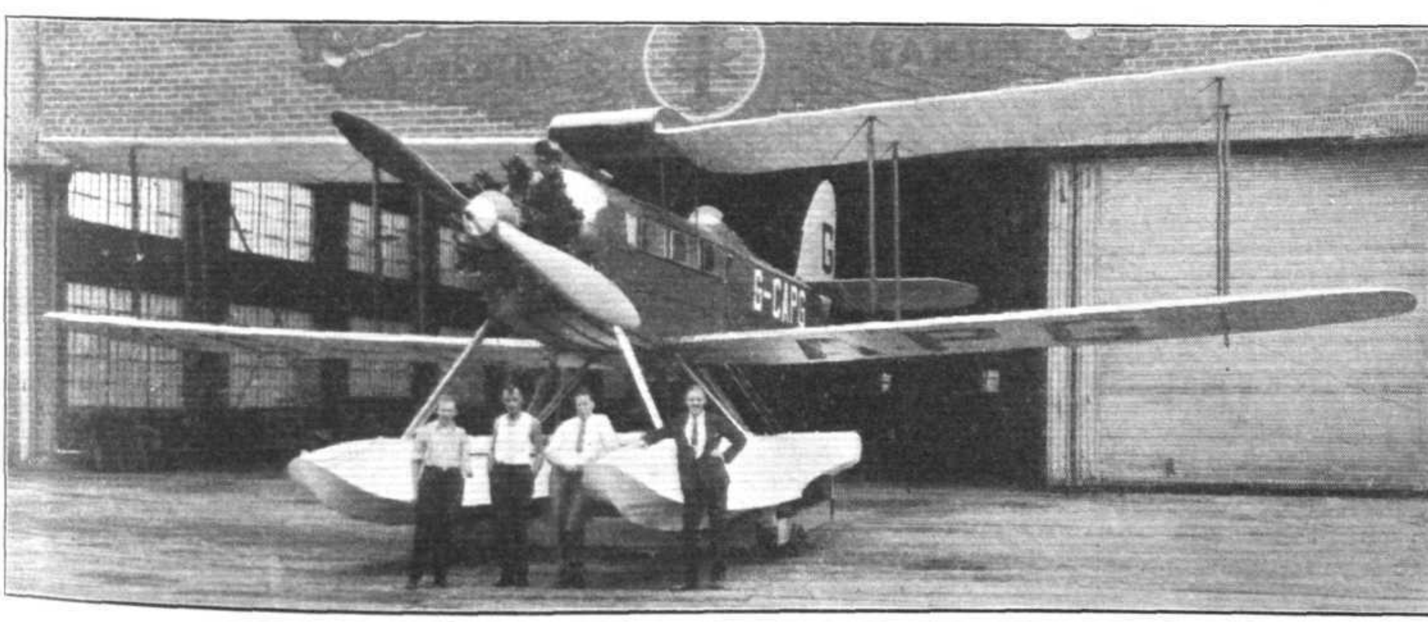
This service operates 11 H.S.2L flying-boats, 10 Gypsy-Moth seaplanes, and a D.H.61 seaplane, primarily for forest fire detection and suppression, but in the five years it has been in existence, it has filled the need for flying service of the following duties in addition: aerial photography and timber type sketching; emergency flights for both the Royal Canadian Mounted Police and the Provincial Police; the transportation of doctors and nurses for the Department of Health and of sick or injured from outlying parts of the Province; in co-operation with the Department of Mines; and in general inspections and surveys by the Provincial Minister of Lands, the Hon. William Finlayson. Its flying hours have mounted year by year, and now reach an aggregate of almost 20,000 hours.

During the summer months of fire hazard, the machines are scattered among a number of bases, each one provided with a comfortable cabin for the personnel, a cook who provides meals at any hour, and a shop for minor repairs, engine changes and the like. Fire detection work is carried out by the Moths, following a regular patrol system. When a fire is spotted, the machine continues a short way along its route until it reaches one of the frequent wireless transmitting stations that have been erected. Here it lands, the report of the fire is handed in, and the machine continues on its flight. By this system, a fire discovered in the early part of the patrol does not cause the latter portion to be neglected, as would be the case if a report had to be carried back to the base, or to headquarters.

Headquarters receives the wireless signal and passes it to the District Forester responsible for the area in which the fire occurs. This official, knowing the disposition of his men and fire-fighting equipment, and also where to obtain additional labour should it be required, makes his plans, and requisitions H.S.2L boats as transport craft to carry the fire-fighting crew to the landing place nearest to the fire. This system has been found to work to the utmost possible advantage and to give remarkable results in the speedy arrival of trained fire fighters, fully equipped, at the scene of action.

On one fire which was spotted by a Moth at Cairn's Lake, 200 miles north of the Canadian National Railway lines last year, and which raged for between three and four weeks, 327 hours of flying were necessary. Practically no other way of reaching the spot existed, and men, tools, food, pumps, hose, petrol, and everything else was transported by air. The weight of material flown in, including food for the crew, amounted to 37,000 lbs., and all the non-consumable stores were flown out again.

The upper picture shows the picturesque and comfortable living quarters, at Remi Lake, provided for the personnel of the Ontario Provincial Air Service. In the lower picture, H.S.2L flying-boat hulls are being overhauled at the reconditioning plant, Sault Ste. Marie.



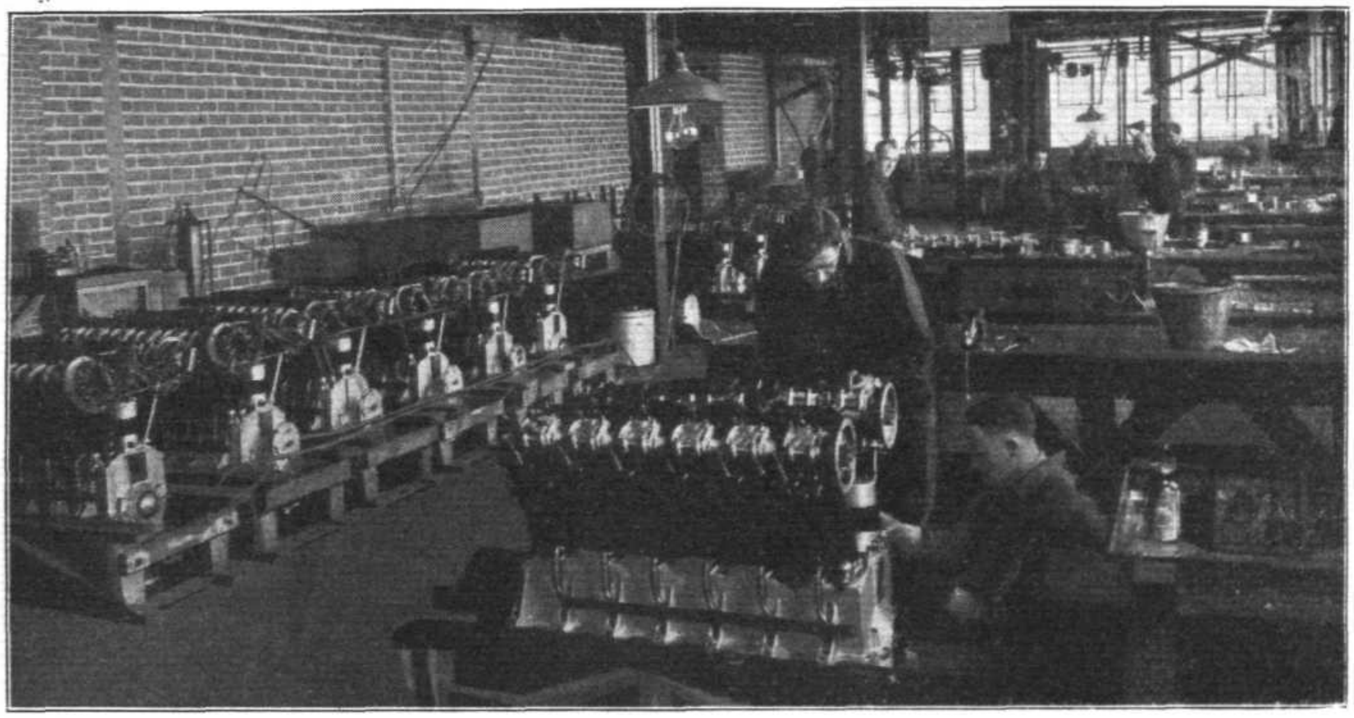
THE **ONTARIO PROVINCIAL AIR SERVICE: The D.H.61 seaplane on the slipway outside the hangar at Sault Ste. Marie. Capt. Maxwell, Director of the Air Service, is in the centre of the picture.**

The area patrolled during the fire season is roughly triangular in shape, the headquarters at Sault Ste. Marie being situated at the apex. Under headquarters, this area is divided into two districts, Operations East, supervised by George Phillips, and Operations West under the supervision of Major R. E. Nicoll.

The main reason for the efficiency of the service, and for the fact that such remarkable results have been achieved with the H.S.2L boats, which have been considered obsolete in many quarters for years past, lies in the reconditioning process undergone by every machine each winter in the extremely well-lit, heated and fireproof hangar at "The Soo." The Director of the Air Service, Captain W. R. Maxwell, to whose initiative and foresight both the well-equipped hangar and the first utilization of the Moth seaplane are due, puts this in a sentence, "Every machine that has been reconditioned as we recondition them, is to all intents and purposes a new machine." Replanking of hulls, refabricating of planes, scraping, inspection and repainting of each and every part of every craft are regular routine, and all the year round employment is found for a large crew of skilled workers in these duties.

Captain Maxwell's motto is: "Select the best of personnel, and keep 'em well and happy." To this end, not only at headquarters, but at the most remote outpost, accommodations are comfortable, shops are warm and dry, and recreational facilities are well to the fore. From April to November the machines and crews are at their various bases; then all machines are flown to Sault Ste. Marie; most of the pilots are paid off; and the winter work of reconditioning the fleet begins. A flying bonus of $2 an hour, in addition to their basic pay, recompenses the pilots for the winter's inactivity to some extent, and, indeed, many of them are content to wait for the return of Spring with equanimity, while some others join commercial aviation concerns and carry on flying all winter. As the Ste. Mary's River, on the banks of which the main hangar stands, is free of ice in March, all machines can be air-tested before the opening of the season in April.

A. H. S.



THE ONTARIO PROVINCIAL AIR SERVICE: A view of the engine shops at Sault Ste. Marie.

◈ ◈ ◈ ◈

Schneider Trophy Race

The Royal Aero Club, the Air Ministry and the Automobile Association's aviation branch are arranging for the reception of over 1,000 aircraft, which are expected to arrive for the Schneider Trophy Race over the Solent in September. The aerodromes at Cowes and Hamble will probably accommodate great numbers, whilst there are other sites under inspection for possible use. For visiting seaplanes Cowes Harbour is proposed as a shelter. Official regulations governing the arrival of these air visitors will be issued. The Royal Aero Club announces that the berths on the official ship of the Royal Aero Club, the ss. *Orford*, are being rapidly booked up, and members are reminded that they should apply for their accommodation before Friday, May 10. The accommodation is available to the members and their friends, including those of kindred societies and associated light aeroplane clubs.

Busk Studentship in Aeronautics

The Trustees of the Busk Studentship in Aeronautics, which was established in memory of Edward T. Busk, who lost his life in 1914 while flying an experimental aeroplane, announce that a vacancy has arisen for the Studentship for the year 1929-30. Full particulars and forms of application can be obtained from Prof. B. Melvill Jones, Engineering Laboratory, Cambridge.

U.S. Aviation Development

Two of the largest aeronautical corporations in the United States, which between them control thousands of miles of airways in North and South America are forming an alliance. The United Aircraft and Air Transport Corporation, which owns important subsidiaries in the Boeing Air Transport and Pacific Air Transport Companies, has purchased for approximately £600,000, 50,000 shares of the capital stock of the Aviation Corporation of the Americas, which owns the Pan-America Airways Company. Under the new agreement the Aviation Corporation of the Americas will operate south of the Mexican border and through its present international air lines, and the United Corporation will confine its operations to north of the border. Both corporations propose to extend their activities, and the Boeing Company, the United's subsidiary, has just completed the survey for an airway as a prelude to the establishment of a service between Alaska and Seattle.

German Air Budget in Force

The *Berliner Tageblatt* learns, states the *Daily Telegraph*, that, in consequence of the reduction of its Government subsidies to £500,000, the Lufthansa, which runs all the German aerial lines, has given notice that it may be compelled to get rid of a large part of its staff. In some departments it may be necessary to dismiss as many as 40 per cent. of the personnel. The total length of the combine's air services, which last year was about 6,250,000 miles, is to be cut down to 3,750,000 miles. In another portion of the Press, however, it is stated that the combine is working out a plan "whereby justice will be done both to the unfavourabel financial position of the Reich and to the necessities of German aerial navigation."

Lecture Postponed

The lecture by Captain Sinclair on Wireless for Civil Aviation, originally arranged for May 2 has been unavoidably postponed. There will be no lecture before the Royal Aeronautical Society on that date.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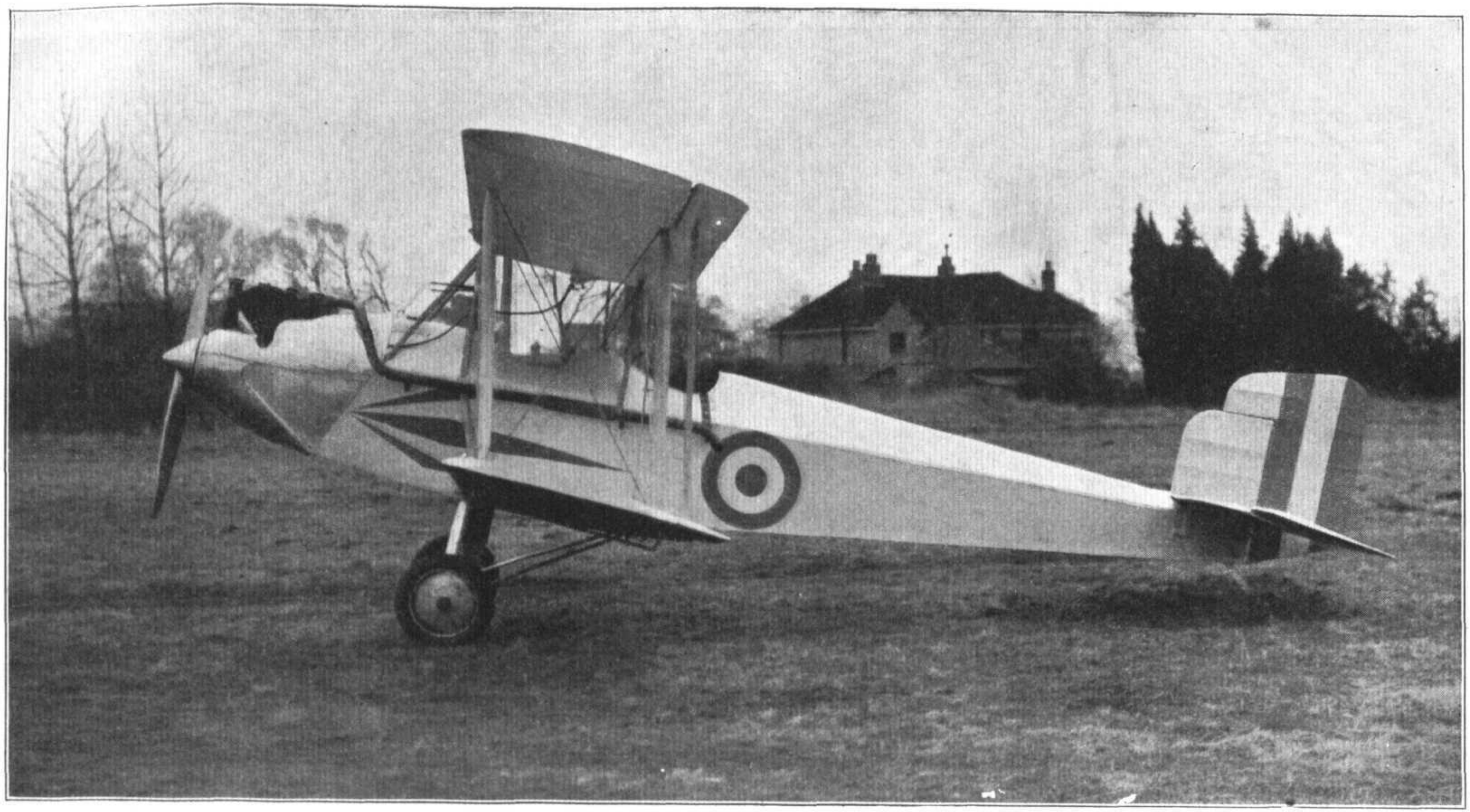

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A FLIGHT TO NEW ZEALAND IN A CIRRUS-SPARTAN PLANNED

Lady Bailey Performs Christening Ceremony

WHEN the war finished it stranded thousands of pilots and observers who felt that no career could be faced unless it was a flying career. The R.A.F. had no further opportunity to utilise their experience and services, and so they turned and tried to storm civil aviation. The situation of civil aviation then quickly disillusioned them, and sadly and reluctantly they drifted to other fields in industry, believing that a flying career was for ever denied them.

Until the appearance of the light aeroplane there was still little hope for them, but now the light aeroplane has slowly been opening a narrow channel for their return. It is providing a new flying career for some, and the sport of flying for others. This has been in evidence for some time in the long distance flights to various parts of the world. So many of the pilots concerned in these flights are making a return to aviation after a lapse since the war. The light aeroplane has largely made this possible. These ex-pilots who had to accept the alternative of finding a new career, in some cases abroad, are trickling back to this country, spurred by the world success of the light aeroplane, purchasing a machine and attempting to fly back to their adopted country after a brief refresher course. Although many of them are taking up their old flying career again through the medium of private flying, they yet cherish the ambition of breaking into commercial aviation from private flying, which gives them an opportunity of rekindling their skill and becoming familiar with modern design.

Some are flying back with agencies for British light 'planes in their possession, to countries where they will be pioneers in the light 'plane movement, faced, therefore, with every chance of success.

Ex-R.F.C. Member's Venture

An example of this return of the ex-war pilot to aviation is connected with the proposed flight to New Zealand from England by Mr. Frank Mase. He is using a Simmonds "Cirrus-Spartan" light 'plane which was christened *The All Black* at Croydon on April 19 by Lady Bailey, who arrived at the aerodrome in her Gipsy-Moth G-AAEE. His "Spartan" machine is standard except for a large tank in the front passenger seat with a capacity of 80 gallons. There are also two separate gravity tanks each containing 10 gallons of fuel.

The advantages of this dual gravity tank system are considerable. There is, of course, an alternative fuel system

["FLIGHT" Photograph

The Hon. Lady Bailey christening the Simmonds "Cirrus-Spartan" light 'plane "The All Black" at Croydon Aerodrome on April 19. In this machine Mr. Frank Mase will attempt a solo flight to New Zealand shortly.

in the event of one system failing. And as the pilot can replenish one tank from the main supply whilst the engine is running on the other tank, he is able to measure the fuel into separate 10 gallons.

Thus he has a means of being certain as to the margin of fuel left at any time, so that, for instance, the decision to push on another stage or land to refuel can be made safely. This total fuel capacity of 100 gallons in Mr. Mase's Cirrus-Spartan gives him a non-stop range of 1,800 miles in still air or about 2,000 miles with a tail wind.

Col. L. A. Strange, director and chief pilot of Simmonds Aircraft, Ltd., tested Mr. Mase's machine at Southampton recently. With a load of 80 gallons of petrol the machine took off in less than 250 yards. Its loaded weight then was over 1,800 lb., or 400 lb. above the usual loaded weight.

Mr. Mase does not anticipate having to take off with a full load often during his flight. An exception will be for the long sea stage of over 1,000 miles from Tasmania to New Zealand, which is likely to be the most dangerous stretch of the whole flight.

Tasman Sea Stage

When one suggested to Mr. Mase on Friday that it was a wide sea flight to essay in a single-engined machine, he obviously did not view it with any apprehension, clearly because he has such faith in his Spartan light 'plane and the "Cirrus Mk. III" engine. He told one that he would not carry wireless during that stage unless he could get some competent wireless amateurs on both sides of the ocean to co-operate with him.

The possibility of the Dominion Governments banning him there was also raised in conversation with Mr. Mase, owing to their action one year ago when two N. Zealand airmen attempted the flight in a single-engine Ryan monoplane and were lost. Mr. Mase, however, does not anticipate this obstacle either. It will be recalled that the *Southern Cross* (Fokker monoplane with three Wright "Whirlwinds") successfully completed a round flight across the Tasman Sea last year, piloted by Sqdn.-Ldr. Kingsford-Smith and Flight-Lieut. C. Ulm. They carried wireless and only ran into any danger when making a landfall on the Australian coast on the return trip. Thick weather was encountered then, in which they became lost at a time when fuel was rapidly running out, but a safe landing was eventually made. Mr. Mase will have 100 per cent. reserve of fuel on his ocean attempt.

"Flight" Photograph

Mr. Frank Mase introducing Lady Bailey before the ceremony in a brief speech which praised Lady Bailey's aviation accomplishments.

The Course

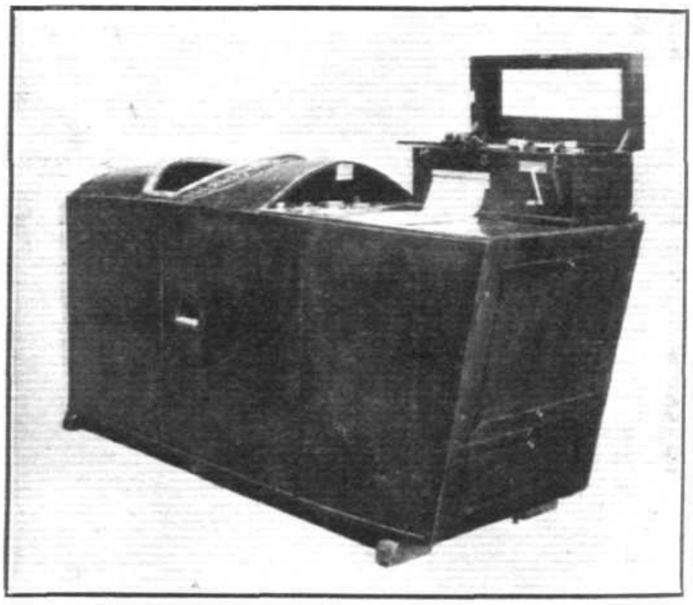
The intended course planned by Mr. Mase is the usual one. He will start from Lympne if the weather is favourable this week and attempt a non-stop flight to Rome. This distance is nearly 900 miles. Then the course will run as follows:—Malta, Benghazi, on the North African Coast, Alexandria, Amman, Baghdad, Basra, Jask, Karachi, Allahabad, Calcutta, Akyab, Rangoon, Victoria Point, Singapore, Batavia, Sourabaya, Bima, Darwin, Sydney, Melbourne and Hobart, Tasmania. He will then continue down to Christchurch, New Zealand. Across Australia he will probably follow the telegraph wires. On this same course, Sqdn.-Ldr. "Bert" Hinkler covered about 12,000 miles when he reached Darwin, North Australia, and as he cut his stages as fine as possible, one can estimate a journey of about 15,000 miles before Mr. Mase. This will be one of the longest solo light 'plane flights attempted, and certainly the longest in one direction. Complete sets of Spartan interchangeable components will be at his disposal, if required, in India, Singapore and in Australia.

Christening Ceremony

At Friday's ceremony, Lady Bailey christened the machine in the usual manner and wished Mr. Mase every success. Mr. Mase spoke in eulogy of Lady Bailey during a brief introductory speech to the audience, which included Mr. F. G. L. Bertram, Deputy Director of Civil Aviation, and representatives of A.D.C. Aircraft, Ltd., and the Hampshire Aeroplane Club. Capt. N. Stack, the A.D.C. Aircraft test pilot, then took off in Mr. Mase's machine and gave one of his usual expert exhibitions with a light 'plane. Col. L. A. Strange flew another "Cirrus-Spartan," then Capt. Stack concluded the show with a typical display on the "Cirrus-Moth."

"Flight" Photograph

Capt. N. Stack, the A.D.C. Aircraft test pilot, taking off in Mr. Mase's Cirrus-Spartan at Croydon to give an exhibition flight. The building behind is the Aerodrome Hotel.



Mr. Mase served in the R.F.C. from 1915 onwards. He has been in New Zealand for four years and is a member of the Auckland Aero Club as well as the Hampshire Aeroplane Club here. When he returns, it is his intention to start passenger and mail air transport services and represent the Simmonds "Spartan." He has been flying with the Hampshire Club since his arrival in this country. For the flight to New Zealand all his maps and the necessary documents for aerial travel abroad have been prepared and supplied by the Aviation Department of the Automobile Association, which is in the care of two private-owner pilots, Mr. Ivor McClure and Mr. O. J. Tapper.

LIGHT 'PLANE CLUBS

London Aeroplane Club, Stag Lane, Edgware, Sec., H. E. Perrin, 3, Clifford Street, London, W.1.
Bristol and Wessex Aeroplane Club, Filton, Gloucester. Secretary, Major G. S. Cooper, The Aerodrome, Patchway, Glos.
Cinque Ports Flying Club, Lympne, Hythe. Hon. Secretary, R. Dallas Brett, 114, High Street, Hythe, Kent.
Hampshire Aero Club, Hamble, Southampton. Secretary, H. J. Harrington, Hamble, Southampton.
Lancashire Aero Club, Woodford, Lancs. Secretary, Mr. Atherton, Avro Aerodrome, Woodford.
Liverpool and District Aero Club, Hooton, Cheshire. Hon. Secretary, Capt. Ellis, Hooton Aerodrome.
Midland Aero Club, Castle Bromwich, Birmingham. Secretary, Maj. Gilbert Dennison, 22, Villa Road, Handsworth, Birmingham.
Newcastle-on-Tyne Aero Club, Cramlington, Northumberland. Secretary, John Bell, Cramlington Aerodrome, Northumberland.
Norfolk and Norwich Aero Club, Mousehold, Norwich. Secretary, G. McEwen, The Aerodrome, Mousehold, Norwich.
Nottingham Aero Club, Hucknall, Nottingham. Hon. Secretary, Cecil R. Sands, A.C.A., 30, Park Row, Nottingham.
The Scottish Flying Club, 101, St. Vincent Street, Glasgow. Secretary, George Baldwin, Moorpark Aerodrome, Renfrew.
Southern Aero Club, Shoreham, Sussex. Secretary, Miss N. B. Birkett, Shoreham Aerodrome, Sussex.
Suffolk Aeroplane Club, Ipswich. Secretary, Maj. P. L. Holmes, The Aerodrome, Hadleigh, Suffolk.
Yorkshire Aeroplane Club, Sherburn-in-Elmet, Yorks. Secretary, Lieut.-Col. Walker, The Aerodrome, Sherburn-in-Elmet.

LONDON AEROPLANE CLUB

(AP. 15-21).—Instructors: Capt. V. H. Baker, M.C., A.F.C., and Capt. F. R. Matthews. Ground engineers: C. Humphreys and A. E. Mitchell. Aircraft: The following machines were in commission: G-EBXS, G-AABL, G-EBZC, G-AABN and G-AAEX. Total flying time for the week: 74 hrs. 50 mins. Dual instruction: 33 members received dual instruction, the time being 34 hrs. 40 mins. Solo flying: 38 members flew solo during the week, the time being 40 hrs. 10 mins. Flying time for Sunday established a record for the club, the time being 23 hrs. 40 mins., and 22 individual members made solo flights. Miss Wood, H. R. Presland and J. W. Radbone made their first solo flights.

"B" licences: W. Basil Swart and H. Kennedy have qualified for their "B" licences.

Club aircraft: On Friday last the club took delivery of their second D.H. Gipsy Moth G-AAEX. This is the machine presented to the club by Mr. J. Scott-Taggart.

BRISTOL & WESSEX AEROPLANE CLUB, LTD.

(AP. 14-20).—Pilot instructor: E. B. W. Bartlett. Ground engineer: A. W. Webb. Machines in commission: (3), YH, TV, and EU kindly lent by Miss Miles. Flying time for the week: 33 hrs. 15 mins. Pupils under instruction: (9), 15 hrs. 20 mins. Soloists under instruction: (2), 1 hr. 35 mins. "A" and "B" pilots: (9), 5 hrs. 40 mins. Passengers: (31), 6 hrs. 15 mins. Test flights: (11), 1 hr.

The club season definitely opened on Friday with a most successful dance at the Spa Hotel, some 250 members and their friends being present. Hugh Frossard's band materially helped to make the evening go with a zip and at our next dance we fully expect a larger gathering. Yesterday we held an informal "At Home" at Lansdown, Bath, which was attended by about 300 interested spectators. Lady Bailey most kindly put forward her visit to Badminton a day to visit us there, and Mr. Parkhouse also came up from Teignmouth after a previous trip there from London, so showing his interest and keenness in the club. We have hopes that this the first of a series of meetings will have resulted in a dozen or so new members. Some 18 joy rides were given to prospective members. Mr. Shaw generously gave up his Saturday afternoon for a "busman's holiday," and helped us through with many joy rides and an exhibition of aerobatics which was greatly appreciated. Mr. Bartlett also inspired numerous ladies with confidence on a none too quiet day, besides two exhibition flights, one spectacular and the other a very striking exhibition of slot control. Mr. Bartlett brought "Pixie" back from Yate this week. We purchased a new "Cherub" and this has been most generously fitted, with the necessary structural alterations, by Messrs. G. G. Parnall & Co. We have to thank Miss Miles for having lent her new Gipsy Moth for demonstration purposes at Lansdown, so as to allow one club machine to be used there and for instruction to continue at the aerodrome which was undertaken by Mr. Culverwell.

HAMPSHIRE AEROPLANE CLUB

(AP. 13-19).—Pilot instructors: Flight-Lieut. F. A. Swoffer, M.B.E., and Mr. W. H. Dudley. Ground engineers: Mr. E. Lenny and Mr. J. Elliott. Aircraft: D.H. 60 Moth G-EBOI and Avro Avian, G-EBVI. Flying time for the week: 39 hrs. 35 mins. Pupils under instruction: (30), 20 hrs. 50 mins. "A" pilots: (14), 9 hrs. 10 mins. Soloists: (4), 2 hrs. 15 mins. Passengers: (17), 3 hrs. 30 mins. Instructors solo and tests: (12), 3 hrs. 50 mins.

Messrs. Kerr, Bayly, Hume, Wright, Currie and Dunkerley have joined the club this week as pilot members. Miss Pike, Lieut. Couchman, R.N., and Mr. Shand have each made a successful first solo flight.

On Friday Mr. Frank Mase's "Spartan" the "All Black" was christened by Lady Bailey at Croydon. A number of members and friends were present (to say nothing of a host of photographers!), and everyone joined in wishing Mr. Mase the best of good luck. Incidentally, he is taking with him a letter of greeting from the Hampshire Club to the Auckland Aero Club, of which he is also a member.

Members are reminded that the secretary would like to hear as soon as possible from those who intend being present at the dance at the Assembly Rooms, Southsea, on Friday, the 26th inst. He still has some tickets for sale, price 15s. double and 8s. 6d. single.

LANCASHIRE AERO CLUB

(AP. 14-20).—Flying time: 32 hrs. 30 mins. Instruction: (20), 12 hrs. 25 mins. Solo flights: (22), 13 hrs. 15 mins. Passenger flights: (19), 4 hrs. 20 mins. Tests: (17), 2 hrs. 30 mins. Instruction (with Mr. Hall): Lister, Paddock, Stern, Goss, Weale, Forshaw, Sellers, Fallon, Collins, Wilkinson, Miss Emery, Barlow, Foote, Secker, Kay, Whitehouse, Ashworth, T. H., Maxwell, Gerrard; (with Mr. Scholes): Mr. Mills. Machines in commission: EC, QL, MQ. Soloists (under instruction): Messrs. Williamson, Goss, Forshaw, Sellers, Stern. Pilots: Messrs. Tweedale, Cohen R. F. Hall, Meads, Garner, Mills, Lacayo, Harrison, Weale, Fallon, D. Nelson, Goodfellow, Hardy, Whitehouse, Kay, Twemlow, Michelson. Passengers (with Mr. Hall,): Messrs. Mercer, Faulkner, Richardson, Warren, Mrs. Pitts; (with Mr. Goodfellow): Messrs. Wiesle, Ward, Banks, Johnson, Marland, White, E. Banks; (with Mr. Michelseon): Miss Payne, Mr. Cubberley; (with Mr. Meads): Mr. Moore; (with Mr. Lacayo): Messrs. Whitehouse and Finney; (with Mr. Mills): Messrs. Cliffe and Goodfellow.

Despite somewhat boisterous weather nearly 60 members of the club have been in the air during the week. QL seems to be right out of luck at the moment. After a very brief return to the fold she was placed gently but firmly into the pond by Mr. Lacayo on Thursday. The damage was not very great, but sufficient to keep QL out of action over the week-end.

Last Sunday a party of Rover Scouts from Manchester visited the aerodrome and were shown "what makes the wheels go round." Half a dozen of them were given short flights.

Mr. Collins commenced instruction this week, and is causing far less anxiety to Mr. D. E. Hall than he is doing to the 15 hardy members who are attending his Navigation lectures. The latter may be seen brooding darkly about the aerodrome, while Mr. Mills is reported to have lost at least 5 stone in weight.

Two more members have placed orders for machines this week. Mr. Cohen is buying a Standard Avian, while Mr. J. C. Cantrill is getting a machine for business purposes. He has chosen an Avian with a "Gipsy" engine, a combination which is unusual but which ought to be very effective.

LIVERPOOL & DISTRICT AERO CLUB

(AP. 14-20).—Machines in commission: Avro Avians, G-EBZM, WK, XX, XY. Instructors: Flight-Lieut. J. B. Allen and Flight-Lieut. Sullock (Hon.). Ground engineers: Messrs. H. Pixton and Mason. Rota, flying time: 34 hrs. 10 mins. Pupils, dual: (25), 17 hrs. 40 mins. Pupils' solo: (6), 3 hrs. 20 mins. "A" pilots: (13), 7 hrs. 45 mins. Passengers: (12), 4 hrs. 20 mins. Test flights: (12), 1 hr. 5 mins.

Congratulations to Mr. T. T. Gleave and Mr. G. T. Cowan, who both made excellent first solo flights this week.

Messrs. Thornton and Leete flew over to Southport on Saturday to support an informal meeting which, it is hoped, may be the beginning of an aero club for that town.

A press photographer had an ambition to take aerial pictures of Liverpool this week, but his enthusiasm waned when he found it was impossible to manipulate his camera when he was strapped in. After five minutes in the air Allan received an urgent S O S—and the press is still without photographs. Which reminds one of the classic remark of a cross-Channel passenger, "Such a pity, I'd only lunched half an hour ago; it was nearly new!"

MIDLAND AERO CLUB

(AP. 14-20).—The total flying time was 33 hrs. 30 mins. Dual: 16 hrs. 45 mins. Solo: 8 hrs. Passenger: 8 hrs. 5 mins. Test: 40 mins.

The following members were given dual instruction by Flight-Lieut. T. Rose, D.F.C., and Mr. W. H. Sutcliffe: L. W. Farrer, F. G. Robinson, M. Turner, G. P. Haylock, H. Coleman, T. W. Wild, P. B. Hackett, G. Norton, H. A. Taylor, H. J. Barnett, J. H. Stevens, L. V. Mann, Dr. W. G. Tilleke, C. T. Davis, T. G. Ellison, J. A. Ridsdale, N. B. Tompson, H. Beamish.

"A" Pilots: S. G. Hall, R. L. Jackson, S. H. Smith, E. P. Lane, W. Evershed, R. D. Bednell, M. A. Murtagh, W. M. Morris, J. Cobb, W. L. Handley, W. Swann, J. K. Morton, G. V. Perry, A. Ellison, S. Duckitt, G. C. Jones.

Soloists: H. Coleman, J. H. Stevens.

Passengers: E. Hanson, R. Partridge, W. Breedon, Miss M. Pryce, T. B. Hallam, R. Ashford, S. James, C. H. Perry, Miss R. C. Toppin, G. Ellison, R. Taylor, A. F. Hill, L. Rowley.

EBXT is now in commission again on completion of annual overhau for renewal of C. of A.

NEWCASTLE-UPON-TYNE AERO CLUB

(AP. 15-21).—Instructor: G. M. S. Kemp. Engineer: K. C. Brown; Assistant, J. Tait. Aircraft: (3), PT, QV, LX. Flying time: 41 hrs. 10 mins. Instruction: 17 hrs. 45 mins. Solo training: 2 hrs. 5 mins. "A" pilots 15 hrs 25 mins. Passengers: 4 hrs. 35 mins. Test: 1 hr. 20 mins.

THE NORTHAMPTONSHIRE AERO CLUB

(AP. 7-13).—Instructor James Bunning. Ground engineer: J. Gallagher Aircraft: One (RX). Flying time: 4 hrs. 40 mins.

The weather has been unfit for flying the whole week except for part of two days. Mr. S. P. Tyzack has now gone solo, and the bar has profited in consequence. RX developed trouble with the impulse starter, but upon telephoning Messrs. B.T.H. at Coventry we were immediately helped out of our trouble and received from them a complete magneto on loan within a few hours.

NOTTINGHAM AERO CLUB

(Ap. 13–19).—Pilot instructor: K. K. Brown. Ground engineer: F. H. Harley. Aircraft in commission: Two D.H. "Moths," G-EBQW, G-EBPU. Total flying time: 26 hrs. 10 mins. Solo: "A" licence pilots: 6 hrs. 25 mins. Solo, pilots under instruction: 2 hrs. 50 mins. Dual: 12 hrs. 25 mins. Tests: 2 hrs. 5 mins. Passenger flights: 2 hrs. 25 mins.

Mr. Brown has been advertising the film "Wings" for one of the local cinemas, by flying over the town with banners attached to "QW."

SCOTTISH FLYING CLUB, LTD.

(Ap. 7–20).—Instructor: R. M. Stirling, A.F.C. Ground engineer: W. A. Calder. Machines in commission during period: X Moths, G-EBUX, G-EBYG, G-EBWI. Total flying time: 41 hrs. Dual instruction: 14 hrs. 45 mins. Solo flying: 6 hrs. 25 mins. Passenger flights: 17 hrs. 10 mins. Tests: 2 hrs. 40 mins. Instruction (with Mr. Stirling): Messrs. A. Walter, A. McIlwaine, J. W. Harrington, R. R. Allan, D. Barclay, D. D. Thomson, J. E. R. Young, K. Templeton, H. E. Fairley, D. A. Graham, A. Fyfe Burns, R. D. Campbell, J. J. Nicholson and Miss E. A. Anderson; (with Mr. Yuill): Miss Anderson and Mr. A. McIlwaine (with Mr. Steel): Mr. D. A. Graham.

The general improvement in weather conditions and in flying time, noted n our last report, has been pleasantly sustained during the past two weeks, and, in consequence, much satisfactory progress has been made in instructional work. On April 7, Mr. A. Walter carried out a most successful first solo flight, and we look forward to his obtaining an "A" licence very soon. Mr. D. D. Thomson completed the "A" licence tests on April 8 and 9, and s to be congratulated on the award of a Royal Aero Club certificate.

Preliminary announcement is made of the first of our summer functions, which will be in the form of a garden fete within the ground of Crosslees House, Thornliebank—again very kindly placed at the club's disposal by Mr. Robert Hendry. This will be held on Saturday, June 8, and it is hoped that all who can will give their assistance.

SOUTHERN AERO CLUB

(Ap. 15–21).—Flying times have kept up to a fair average, and at the week end, despite the gusty nature of the wind, our dual Avro, G-EBYB was kep very busy.

During the week, three new members joined the club—Lord Carlow, Mr. Haddock, and Mr. Welch.

On Wednesday, Mr. Miles and Mr. Bellairs, flying on the latter's "Avian" from Yate Aerodrome, Gloucester, to Shoreham, encountered a thick ground fog on arrival, and were compelled to land on a high point on the Downs a few miles away. The machine was flown back to the aerodrome the next morning.

YORKSHIRE AEROPLANE CLUB

(Ap. 14–20).—Pilot instructor: Flight-Lieut. H. V. Worrall. Ground engineer: R. Morris. Asst. ground engineer: G. Speight. Machines in commission: Two (G-EBSV and G-AABD). Flying time for the week: 23 hrs. 40 mins. Instruction: (15), 10 hrs. 10 mins. Soloists: (3), 2 hrs. "A" pilots: (11), 9 hrs. 35 mins. "B" pilots: (1), 1 hr. 30 mins. Passengers: (2), 20 mins. Tests: (1), 5 mins.

Two new flying members, Mr. Pollock and Mr. Sykes, have joined this week and commenced dual instruction.

On Sunday, Mr. Parkinson, Mr. Moon, and Mr. R. Fields all did their first solo and all three put up a very good show.

FROM THE FLYING SCHOOLS

Brooklands School of Flying, Brooklands Aerodrome

(Ap. 15–21).—Instructors for the week: Capt. H. D. Davis, A.F.C.; Capt. E. A. Jones; Maj. C. M. Pickthorn, M.C.; and J. M. Oliver. Machines in commission: DT, WJ, EM, CA, PR, MV, YO. Flying time: 35 hrs.

One of the outstanding achievements of this week was by Mr. S. K. Lee, one of our Chinese pupils, who carried out an excellent height test and approached with engine shut off from 8,000 ft., landing right on a pre-arranged spot on the aerodrome. Mr. Lee, in his early solo stages, had been considerably unnerved by a R.A.F. pilot in a "Siskin" scout, who persistently dived over his bows and made small circles round him during the flight.

Mr. Bennett, one of the officers of the Auxiliary Air Force, carried out an excellent height test and Mr. H. D. Bharucha carried out a very satisfactory first solo.

We have started a new system of "Fly yourself" hire and this was taken advantage of at once by Capt. Blackmore, having gone off on MV to Rotterdam on Saturday, and at the moment we are still living in hopes that he will return sometime. Capt. Jones has also gone off on hire work between Croydon and Manchester on the D.H.50, G-EBQI, so it seems that this form of transport is becoming rapidly more popular.

The following new pupils are welcomed to the school: Messrs. Matthew, Maitland, Verney, Cross, and our third Chinese student, Mr. H. W. Mok.

North Sea Aerial and General Transport, Ltd., Brough Flying School

(Ap. 14–20).—The fine weather of last week has resulted in our flying time for the week approaching more nearly to its normal figure than has been the case during the winter months. The total time flown at the school during the week was 49 hrs. 5 mins., of which 38 hrs. 50 mins. were accounted for by the land machines and the remaining 10 hrs. 15 mins. on the seaplane school.

The totals are made up as follows: On the land machine side Messrs. A. G. Loton and J. B. Stockbridge gave 5 hrs. 10 mins. dual on "Darts" and Flight-Lieut. Preston and Flying Officers Thomas, Lee, Messenger, Alexander, Shephard and Thurrell carried out 28 hrs. 5 mins. solo. Flight-Lieut. Preston left on Wednesday, having completed one quarter's training and Flying Officers Alexander and Thurrell on Friday, having completed two quarters each.

Two of our *ab initio* pupils, Pilot Officer Stanley and Clarke, received 5 hrs. 5 mins. dual from Mr. Loton on "Bluebirds," and the remaining land machine time was occupied by test flights, two being carried out by Mr. Loton, and one by Capt. N. W. G. Blackburn.

Flying Officers Petter and Offord received 2 hrs. 5 mins. dual from Flight-Lieut. N. H. Woodhead on "Velos" seaplanes and carried out 8 hrs. 10 mins. solo. Flying Officer Offord left on Friday, having completed two quarters' training.

Phillips and Powis School of Flying, Reading Aerodrome

(Ap. 14–20).—Flying time: 12 hrs. 30 mins. Instruction: (with Flying Officer R. T. Shepherd), 11 hrs. 37 mins. Passenger flights: 55 mins.

We wish to record the names of the school's first pupils. They are Miss Grieveson, Messrs. Adams, Parsons, Swann, Hieatt (of T.T. fame), Broad, Stewart, Garde, Bloomfield, and Mrs. Morris. All are doing well and some are already about to be launched solo.

Our pupils appreciate the fact that any direction of wind suits the aerodrome; hence they can fly every day.

Surrey Flying Services School of Flying, Croydon Aerodrome

(Ap. 9–22).—Instructor: J. F. Flynn. Ground engineers: F. A. Kent and R. Fox. Machines: (2), VA and BW. Hours flown: 64 hrs. 10 mins. Passengers carried: 1,204.

Flying during the past two weeks has been good, all pupils showing great signs of being fair pilots. Six new pupils joined the school since we last reported, and each seems to be shaping well. Mr. Brunning has completed his tests, and therefore joins the band of "A" licence pilots.

Mr. Rogers has put up a very good show during last week, when he took his Avian on a business tour to Bristol, Plymouth, Teignmouth, and Dorchester, and with the exception of Bristol all landings were made in fields selected by him when flying. This is all the more to his credit, and the flight was his first attempt at cross-country flying, and his times between each place were good. He also carried a friend of his as passenger.

Joy flying is gradually on the increase, and our Clerget Avros are being kept reasonably busy.

OVERSEAS CLUBS

THE KARACHI AERO CLUB, LTD.

(Mar. Report).—Our activities during March were as follow:—Dual instruction: 80 hrs. 20 mins. Unqualified solo flying: 8 hrs. Qualified solo flying: 31 hrs. 50 mins. Test flights: 8 hrs. 40 mins. Total: 128 hrs. 50 mins.

We think this result must be considered very creditable in view of the fact that the only machines employed were our two Moths VT-AAA and VT-AAB, and that each machine was in turn out of action for six days during minor repairs.

During the month 30 pupils received instruction, and of these Mr. O. A. Guggenheim obtained his "A" certificate and Mr. E. Bain completed the tests satisfactorily and his application has since gone in.

"B" licences were also obtained by one ex-pilot and one serving officer of the R.A.F., so as to assist in an honorary capacity the club's pilot instructor, Flight-Lieut. W. Jones, R.A.F.O.

Our membership now numbers 121, of whom 59 are Europeans and 62 are Indians.

The first cross-country flights were conducted over the Easter holidays, when two flights totalling 8½ hrs.' flying time were carried out.

On March 17 the club gave joy rides to members of the Karachi public from the landing ground on the Mangho Pir Road, only 2¼ miles out of Karachi, which we hope subsequently to obtain for our new aerodrome. On that date joy rides were given to 35 passengers and in addition an exhibition of stunts was given by the club's instructor, and also by Flight-Lieut. J. B. H. Rogers, R.A.F., who kindly assisted to make the day a success.

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Private Owners in Ireland

Mr. O. G. Esmonde, T.D., who is Chairman of the Council of the Irish Aero Club, Ltd., and one of the directors of Irish Airways, Ltd., arrived at Baldonnel Aerodrome recently from London on a "Gypsy-Moth" which he has purchased for his own personal use. Mr. Esmonde is thus the second private owner of a 'plane in the Free State, the other being Mr. J. Mitchell, Dunboyne. Mr. Esmonde, who was accompanied by Col. C. Russell, flew from Stag Lane Aerodrome, and arrived at Baldonnel after a journey lasting 3½ flying hours.

Pioneering in the North

Malcolm Campbell, Ltd., who represent the De Havilland Aircraft Co., Ltd., for "Gipsy-Moths," arranged an enterprising demonstration last week-end at Southport. They sent two machines up from Stag Lane—one the "Genet-Moth" OU piloted by Mr. J. D. Armour, and the other the "Gipsy-Moth" ET piloted by Mr. P. W. Ballantyne (of the De Havilland Aircraft Co., Ltd.). Some prospective private owners were taken for flights, and it seems likely that they will join the ranks of private owners when suitable accommodation can be found for the machines in the district. For two days, Saturday and Sunday, Mr. Ballantyne spent hours taking up local residents for joy-rides, including the Mayor and Mayoress (Councillor and Mrs. J. Brooks), whilst Mr. Armour delighted the crowd with stunting on the "Genet-Moth," particularly with inverted flying. There was strong evidence that this pioneer work will have an immediate effect upon the district in the interests of aviation. The Mayor and Mayoress were especially delighted with their flying experience with Mr. Ballantyne. Later in the day Mr. Ballantyne and Mr. Armour flew back to London, after two days of steady endeavour in the "cause."

Southport Aero Club Proposed

On Sunday, April 21, the Lancashire and Liverpool Aero Clubs sent their Avro "Avians" to Southport on behalf of a movement to form a local aeroplane club.

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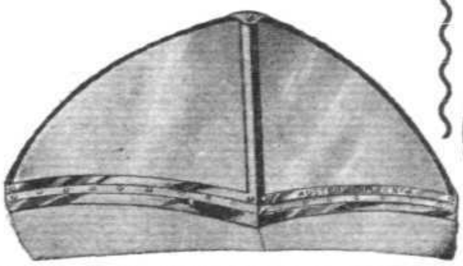

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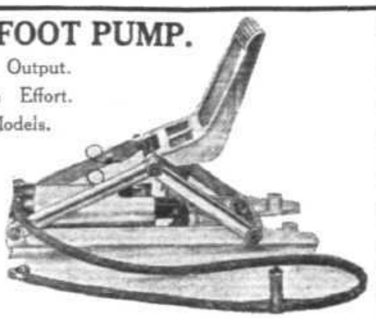

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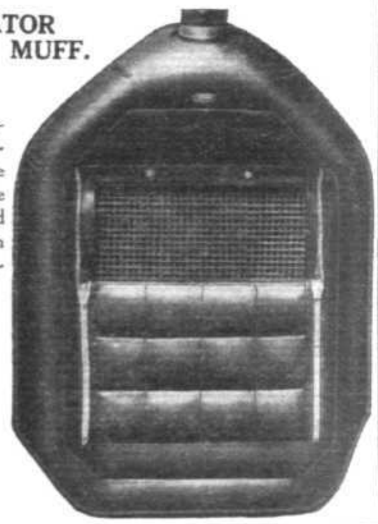

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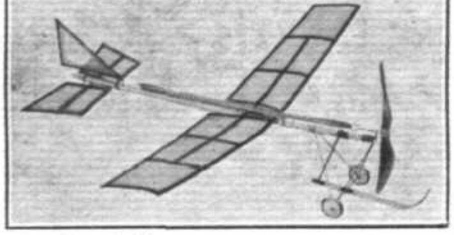

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AIRISMS FROM THE FOUR WINDS

South African Air Records

SIR PIERRE VAN RYNEVELD and General A. J. Brink have broken their very recent record of 6 hrs. 55 mins. for a flight between Pretoria and Cape Town in a machine fitted with a Bristol "Jupiter" engine. Flying back to Pretoria on March 23 from Cape Town, in a D.H.9 ("Jupiter" geared type) they completed the journey in 6 hrs. 50 mins. A head wind impeded their flight for nearly the whole of the distance.

Lost Australian Airmen Found Dead

CAPT. BRAIN, of the Queensland and Northern Territories Aerial Service, has found the missing monoplane *Kookaburra*, in which Lieut. Keith Anderson and Mr. Hitchcock left Alice Springs on April 10 to fly to Wyndham to take part in the search for the *Southern Cross* which, as reported last week, was found with its crew alive, though suffering from starvation. Capt. Brain found the *Kookaburra* on April 20, about 80 miles west by north of Powell's Creek, and 375 miles north of Alice Springs. He was unable to land, but on flying low he saw a body lying under the wing of the monoplane which had landed apparently undamaged. He believed the body to be that of Anderson. Hitchcock was not there. Water and food were dropped by parachute. Bushmen are setting out for the spot. Lieut. Anderson served in the R.F.C. during the war and was reputed to have brought down nine enemy machines. The *Southern Cross* successfully took off, on April 18, from the mud flat on which it was stranded after coming down during the last stage of the flight from Sydney to Wyndham. It flew to Derby in two hours, and Sqdn.-Ldr. Kingsford-Smith and his crew were given a reception. Later the monoplane took part in a search for Lieut. Anderson.

Air Mail from India

THE second India-London air mail, consisting of over 16,000 letters, which left Karachi on Sunday, April 14, arrived at Croydon Aerodrome in a Handley-Page (Napier) air liner on April 20. This was the largest mail yet carried on the new Imperial Airways route connecting London and India.

Graf Zeppelin's Latest Cruises

THE airship *Graf Zeppelin* landed at Friedrichshafen on April 20, after a 10-hour trip over the Upper Rhine. The chief purpose of the flight was the carrying out of experiments with the rotary compass in comparison with the ordinary compass. The airship again left Friedrichshafen at 1.30 p.m. on April 23 on a second Mediterranean cruise, which is not intended to last more than 60 hours, and is expected to cover the Western Mediterranean area. As on previous occasions, a number of official personages are on board. The Zeppelin flew over Chalon-sur-Saone at 5.30 p.m. and over Bordeaux about 9 p.m. She was then making for Spain.

Another Atlantic Flight Proposed

A FLIGHT from Baldonnel aerodrome in Ireland to Chicago will be attempted this summer by two Polish airmen, M. Vladimir Klicz and Capt. Adam Kowalczyk. It is being sponsored by Mr. Stanley Adamkewicz, a Chicago alderman and banker, and is being financed by a group of Poles and Americans in Chicago, including Mr. Cyrus McCormick, the millionaire. The airmen, with Mr. Adamkewicz, have left for Ireland to make preparations for the flight. Their machine will be a Caproni amphibian driven by four engines, each developing 300 h.p. It will be flown to Ireland in June when the first part of the flight—to New York—will be started.

Atlantic Flight Mystery ?

REUTER'S Agency learned that the following message was received at Malin Head (N. Ireland) radio station from the British trawler Shackleton last Saturday. "An aeroplane bound east passed here this morning at 5 o'clock. The trawler is fishing in position 58·10 N., 14·20 W." [The position indicated is about 250 miles to the west of the Outer Hebrides.] The Air Ministry have no knowledge of any flight over the Atlantic.

New World's Record Claimed

A NEW world's record is claimed for a Rohrbach Roma seaplane which, carrying a cargo of about 6½ tons, reached an altitude of 7,200 ft. at Travemuende (the outport of Lubeck) recently.

Record French Flight on "Titan" Engine

THE French airmen, MM. Bailly, Reginensi and Marsot (mechanic) arrived at Le Bourget, Paris, on April 21 at the conclusion of a successful rapid flight from Paris to Saigon, French Indo-China and back. Leaving Paris on March 26 in a Farman F. 190 cabin monoplane fitted with a Gnome Rhone "Titan" engine (the Bristol "Titan" manufactured in France under licence), they reached Saigon on April 5. The return flight was started on April 12 and completed in nine days. This flight was a private venture financed by M. Bailly and about 16,000 miles were flown in 19 days.

Belgian Airmen Killed in Congo

THE Belgian airman, M. Thieffry, has been killed in the Congo. M. Thieffry's machine was caught in a storm on April 10 near Kibanga Bay, on Lake Tanganyika. It crashed and M. Thieffry and his pilot, M. Julien, were killed, the mechanic being very seriously injured. M. Thieffry won distinction as an airman during the war. He was 36 years old, and an advocate at the Brussels Bar. At the time of his death he was engaged in organising commercial air lines in Kivu. The news of his death was sent to Brussels by the airman's sister, who is a nun in the Congo.

ENGLAND—? Above, the Fairey (Napier "Lion") monoplane in which Sq.-Ldr. A. G. Jones-Williams and Flt.-Lieut. M. H. Jenkins set out from Cranwell, at 10.37 a.m., on April 24 in an attempt to fly over 5,000 miles non-stop towards India.

A.I.D. T.S.A., FOURTH ANNUAL DINNER

THOSE who have been privileged to attend previous annual dinners of the Technical Staff Association of the Directorate of Aeronautical Inspection might be forgiven for regarding each gathering as the "high-water mark," and for assuming that the next cannot possibly be as interesting, charming and altogether enjoyable. Yet, somehow, largely no doubt due to the genius of Mr. Jack Jarvis, in whose hands the organisation is, each succeeding dinner always manages to be just a little better and brighter than was the preceding one. Such again was the case of the fourth annual dinner which the A.I.D. Technical Staff Association held at Hotel Russell, Russell Square, on Friday, April 19, under the chairmanship of Mr. J. J. A. Gilmore.

Some 300 diners gathered together in a spirit of good fellowship and did justice to a very excellent dinner. As one looked around the tables one was impressed by the number of representatives of the aircraft industry present, and who provided the best possible proof of the friendly relations which exist between the industry and the A.I.D.

After the loyal toast, Air Vice-Marshal Sir John F. A. Higgins, K.C.B., K.B.E., D.S.O., A.F.C., Air Member for Supply and Research, proposed the toast of the A.I.D. Recalling that this was the third time he had had the pleasure of proposing this toast, Sir John remarked that the first time he knew nothing about the A.I.D., and moreover, everyone present knew he knew nothing. The second time he was under the impression that he did know something, and consequently he was able to speak with that authority and confidence which only comes of ignorance. This time he knew that he knew nothing. However, he was going to "boost" the A.I.D. This he could do all the better as it was a fact that when the A.I.D. had inspected and passed a thing, the Royal Air Force knew that thing was *right*. "So long," Sir John continued, "as you do that, you are doing your job." Referring to the way in which the A.I.D. had kept up with the times, Sir John pointed out that when the change from wood to metal construction came, the A.I.D. was able to adapt itself to the change. So also, he was sure, if in the future other changes were to take place, the A.I.D. would always keep up to date.

Lieut.-Col. H. W. S. Outram, C.B.E., Director of Aeronautical Inspection, in replying to the toast of the A.I.D., complained that he was rather against holding the annual dinner on the same day as the annual conference, because this meant that he had already said all he had to say. He regarded it as a great achievement on the part of the A.I.D. that they should have Sir John Higgins proposing the toast for three years in succession, and still more that on the third occasion Sir John should still desire to "boom" the A.I.D. He would not refer to the presence there of such a full representation of the aircraft industry, as the chairman would probably have something to say about that, but he would like to draw attention to the fact that they had with them that evening one whom many of them knew many years ago. He was referring to Mr. Marcel Desoutter. It was, Col. Outram thought, gratifying to find that about a month after he (Desoutter) started business as an aircraft constructor he was present at the A.I.D. dinner. Col. Outram also referred to the presence of Capt. Irving, who was responsible for the car on which Maj. Segrave had recently established a world's record.

Mr. J. J. A. Gilmore said his duty was to propose the toast of the visitors and guests. The distinction, he understood, was that the visitors had paid for their dinner, the guests had not! Referring to the presence of Sir John Higgins, Mr. Gilmore said it was an indication of the interest he took in the A.I.D. that he attended these dinners every year. He was sure all present would have noted with pleasure that His Majesty had conferred added distinction on Sir John in the Birthday Honours List. He was also pleased to welcome Sir Walter Nicholson, and thought the Air Ministry fortunate in having in his person such a distinguished permanent secretary.

Another very welcome guest that evening was Mr. McAnally. Last year Mr. McAnally had recommended him (Mr. Gilmore) to continue his biblical studies. This he had not, unfortunately, been able to do, as he had to go to Belfast on duty. While there, he saw one day a Latin quotation. Not being a Latin scholar himself, he asked a friend to translate it for him, and was told that the quotation could be translated freely "tuppence ha'penny for a threepenny bit." He hoped the Promotions Board would keep that before them.

He was pleased to note that the Society of British Aircraft Constructors was well represented that evening, and particularly glad to note their general appearance of affluence in spite of the Directorate of Contracts. Particularly would he mention the presence of Mr. Handley Page and Mr. Pate. It was good to reflect that (perhaps helped just a little by the Air Ministry) British aircraft were highly esteemed all over the world. He recalled that in the earlier days the A.I.D. was apt to be blamed for the misdeeds of the Air Ministry. Now that was all changed, and he hoped the main burden would be shifted to the R.T.O. (Resident Technical Officer), while the A.I.D. might be regarded as angels in disguise.

Sir Walter F. Nicholson, K.C.B., Secretary of the Air Ministry, in the course of a very witty speech, remarked that his name had been coupled in the toast with that of Mr. Handley Page. That recalled to him the fact that he and Mr. Handley Page had had quite a good deal of correspondence in their official capacities, and that correspondence did not always give an impression of unanimity of opinion. Perhaps he would have a communication from Mr. Handley Page concerning some product of that well-known firm, and would reply, in a week or two, or perhaps three, that matters were progressing. A little later there would be another letter from Mr. Handley Page going into more detail, to which he (Sir Walter) would reply in a month or two, or perhaps three. Then from time to time there would be a suggestion by Mr. Handley Page of payment of a million or so. In a year or two, or perhaps three, Sir Walter would reply and suggest payment of £10 or so!

Turning to the subject of the A.I.D., Sir Walter complained that he did not, like most of the other guests, know the work of the A.I.D. from beginning to end. To him the work was rather a mystery, and he pointed out that one always took the unknown as the marvellous. He admitted, for instance, that he had never seen an A.I.D. inspector at work! This remark caused much merriment, and Sir Walter then explained his meaning in a different phrasing. He had to observe the A.I.D. from the Air Ministry, and form his judgment of it and of the industry mainly from reports. His observation led him to think that the A.I.D. certainly came in on the ground floor.

Mr. F. Handley Page said he felt rather like a lamb being led to the slaughter. He was also surprised, as he never expected such true revelations of the way in which the Air Ministry conducted its business as those made by Sir Walter Nicholson. He felt relieved that no M.P. was present, otherwise some searching questions might have been asked. On the subject of inspection, he said his first introduction to it was a picture of Adam and Eve which used to hang in his nursery (that was many many years ago when he was a child, and before he became a grown-up child in the care of the Air Ministry!) The picture also included a rabbit, and they used to call the picture the "looking-on" picture. It was, he understood, shortly after that incident that the Chosen Race went into the clothing business, and had never left it since! One thing that had always puzzled him was the basis on which A.I.D. inspectors were "approved." After outlining various unsupportable theories as to standards required, Mr. Handley Page said he had come to the conclusion that the common feature of all A.I.D. inspectors was a very good heart. He was happy to think that in British aircraft construction such a high standard had been achieved, and pointed out that this was only accomplished by the good feeling between the industry and the A.I.D.

Mr. Pate, of the Napier firm, spoke on behalf of the aero engine firms, and said that if Sir Walter Nicholson would come to Acton he could easily have an opportunity of seeing an inspector at work. As a matter of fact, they worked hard. He summarised the position by remarking that half the time the firms did not know how to get on without the A.I.D., and the other half they did not know how to get on with it. He was sure that Capt. Irving would agree with him that if it were not for the Air Ministry Great Britain would not now hold speed records in the air, on land and on the sea.

Maj. J. S. Buchanan, O.B.E., F.R.Ae.S., A.M.I.M.E., Assistant Director of Scientific Research (Aircraft) proposed the toast of the hosts, and Mr. L. Warner responded. Both confined their remarks chiefly to "domestic" affairs of the A.I.D.

Mr. H. W. W. McAnally, C.B., Principal Assistant Secretary of the Air Ministry, proposed the toast of Mr. Jack Jarvis, and the evening came to a close with the singing of "Auld Lang Syne."

Artistes entertained the company in the intervals between speeches, the radio comedian with two christain names and no surname, Mr. Leonard Henry, being a favourite.

THE ROYAL AIR FORCE

ROYAL AIR FORCE INTELLIGENCE

Appointments.—The following appointments in the Royal Air Force are notified :—

General Duties Branch

Air Commodore : F. W. Bowhill, C.M.G., D.S.O., to R.A.F. Depot, Uxbridge, supernumerary, pending posting ; 20.3.29.

Group Capt. : L. W. B. Rees, V.C., O.B.E., M.C., A.F.C., to R.A.F. Depot, Uxbridge, supernumerary pending taking over Command ; 9.4.29.

Wing Commander : A. T. Whitelock, to 10 Sqdn., Upper Heyford, to Command ; 4.4.29.

Sqdn. Leaders : A. H. Peck, D.S.O., M.C., to R.A.F. Depot, Uxbridge : 24.3.29. A. H. Stradling, O.B.E., to No. 4 Flying Training Schl., Middle East ; 2.4.29.

Flight-Lieuts. : P. Warburton, M.B.E., to H.Q., Iraq ; 5.4.29. A. P. Revington, to No. 203 (F.B.) Sqdn., Iraq ; 1.2.29.

Flying Officers : R. Duncanson, to R.A.F. Depot, Uxbridge ; 26.3.29. F. L. Kingham, to R.A.F. Depot, Uxbridge ; 9.3.29. The following Pilot Officers are all posted to No. 4 Flying Training Schl., Middle East, for flying training with effect from 16.4.29 :—G. F. Alexander, W. N. H. Banks, S. J. H. Carr, R. P. Cauthery, R. H. Cave Penney, H. M. B. Collins, E. C. Durbin, E. C. E. Hartley, J. F. M. Hearne, P. S. Hession, O. W. Hoffman, A. C. Larmuth, P. B. Lusk, R. R. Maxwell-Channell, C. S. Millar, M. A. Murtagh, H. B. Robertson, S. H. Turner, F. A. Wardell, and I. M. L. Katferreira.

Pilot Officers : P. G. J. Atkinson, to Aircraft Depot, India ; 2.3.29. E. C. T. Edwards, to 32 Sqdn., Kenley ; 2.4.29. J. F. X. McKenna, R. S. Collins and J. Addison, to 23 Sqdn., Kenley ; 2.4.29. E. M. Thomas, to 41 Sqdn., Northolt ; 2.4.29. P. G. Thomson and H. H. Chapman, to 56 Sqdn., North Weald ; 2.4.29. P. Kinsey, to 16 Sqdn., Old Sarum ; 2.4.29. F. R. Balfour, to 13 Sqdn., Andover ; 2.4.29. D. A. L. Campbell, to 2 Sqdn., Manston ; 2.4.29. C. G. Davies, to 29 Sqdn., North Weald ; 2.4.29. P. Le M. C. Deacon, to 1 Sqdn., Tangmere ; 2.4.29. J. W. Hawke, to 26 Sqdn., Catterick ; 2.4.29. F. R. Jones, to 43 Sqdn., Tangmere ; 2.4.29. W. H. Jones and H. D. McGregor, to 111 Sqdn., Hornchurch ; 2.4.29. G. F. MacPherson, to 17 Sqdn., Upavon ; 2.4.29. H. Kerr, to 3 Sqdn., Upavon ; 2.4.29. M. N. Oxford, to 25 Sqdn., Hawkinge ; 2.4.29. H. J. A. Williams, to 4 Sqdn., South Farnborough ; 2.4.29.

The following Pilot Officers are all posted to R.A.F. Depot, Uxbridge, on appointment to a Short Service Commission (on probation), with effect from April 2, 1929 :—G. F. Alexander, W. N. H. Banks, S. J. H. Carr, R. P. Cauthery, R. H. Cave-Penny, H. M. B. Collins, E. C. Durbin, C. E. Hartley, J. F. M. Herne, P. S. Hession, O. W. Hoffman, A. C. Larmuth, P. B. Lusk, R. R. Maxwell-Channell, C. S. Millar, M. A. Murtagh, H. B. Robertson, S. H. Turner, F. A. Wardell, and I. M. L. Katferreira.

Stores Branch

Flight Lieuts. : S. Bingham, to No. 4 Flying Training Schl., Middle East ; 20.3.29. A. J. Adams, to H.Q., Middle East ; 20.3.29.

Flying Officers : G. J. Gaynor, to 203 (F.B.) Sqdn., Iraq ; 1.2.29. D. J. Divett, to R.A.F. Depot, Uxbridge ; 22.4.29. L. J. V. Bates, to H.Q. Air Defence of Great Britain ; 3.2.29. G. Scarrott, to R.A.F. Depot, Middle East ; 12.4.29. C. B. Horsfield, to R.A.F. Depot, Uxbridge ; 30.3.29. P. Alderson, to R.A.F. Depot, Middle East ; 12.4.29. A. J. Walker, to Aeroplane and Armament Experimental Estab., Martlesham Heath ; 9.3.29.

Accountant Branch

Flying Officers : J. Charles, to 208 Sqdn., Middle East ; 26.3.29. H. J. Titherington, to 203 (F.B.) Sqdn., Iraq ; 1.2.29. D. C. Stone, to 203 (F.B.) Sqdn., Iraq ; 14.2.29.

Medical Branch

Flight Lieuts. : J. Parry-Evans, to 14 Sqdn., Middle East ; 23.3.29. A. Harvey, M.B., to R.A.F. Depot, Uxbridge ; 17.3.29. H. Penman, M.B., to No. 4 Flying Training Schl. (Middle East), instead of H.Q., Middle East as previously stated ; 8.3.29.

Flying Officer : W. Heron, M.B., to R.A.F. Depot, Uxbridge ; 9.3.29.

Chaplain's Branch

Rev. J. A. Jagoe, M.A., to No. 203 (F.B.) Sqdn., Iraq ; 1.2.29.

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GUILD OF AIR PILOTS AND AIR NAVIGATORS OF THE BRITISH EMPIRE

Foundation Council Selected

THE second general meeting of the Guild of Air Pilots and Air Navigators of the British Empire was held at Rules' Restaurant, Maiden Lane, W.C.2, on April 10. Air Vice-Marshal Sir Sefton Brancker, K.C.B., A.F.C., and a large representative gathering of pilots engaged in commercial aviation were present. Sqdn.-Ldr. E. L. Johnston, O.B.E., A.F.C., was in the chair, and in opening the meeting he thanked Air Vice-Marshal Sir Sefton Brancker for his support in launching the Guild of Air Pilots and Air Navigators of the British Empire. He also stated that it was a source of great pleasure to all present that the Guild had been the recipient of a gift of 100 guineas from a donor who wished to remain anonymous. That was a magnificent gesture to the Guild, and augured well for its future, and perhaps, as he (the chairman), being the most optimistic member present, might be permitted to say, the response to the formation of the Guild had far exceeded his most optimistic anticipation.

The response alone showed more than anything else the urgent need that existed for such a professional body of aviators, and because of that he once more appealed to those present to exercise the soundest judgment in approving the memorandum and articles of association, and particularly the qualification for membership. The Drafting Committee had given the greatest thought and attention to those matters, and it was hoped that the resolutions would be adopted with one accord to ensure the establishment of the Guild upon a sound foundation, which would place it in the forefront of the professional bodies and institutions which existed in London.

In the course of the evening the Foundation Council was elected for the purpose of supervising the formation and registration of the Guild. This Foundation Council consists of Maj. H. G. Brackley, Capt. W. L. Hope, Capt. O. P. Jones, Sqdn.-Ldr. E. L. Johnston, Capt. N. Macmillan, Capt. C. R. Macmullin, Capt. A. S. Wilcockson.

Subject to the limitation of members, membership of the Guild is open to certificated air pilots and air navigators who are British subjects by birth or by naturalisation, and who, at the date of nomination, have been for not less than five years the holder of a Class "B" aeroplane pilot's licence or a first-class airship pilot's licence or a certificate of competency as a first-class navigator of commercial aircraft. The Guild is formed principally to promote the consideration and discussion of all questions affecting, and to protect and advance the interests of, the members of the Guild, and the business of commercial aviation. It will constitute a body of experienced airmen who will be available to act as members of or give evidence before Royal Commissions and the like, and by legislative measures consider and promote improvements in the laws affecting commercial aviation. It will seek to improve and elevate the technical and general knowledge of its members, and to promote honourable practice in the profession of commercial aviation.

Application for membership to the Guild in the first place should be made to : The Secretary to the Foundation Council, The Guild of Air Pilots and Air Navigators of the British Empire, Harrowden House, Harrowden, Bedford.

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S. Smith and Sons' Annual Dinner

ON April 13, at the Hotel Russell, the annual dinner and dance of S. Smith and Son (M.A.), Ltd., was held. These well-known manufacturers of motor and aeronautical instruments had a thoroughly enjoyable evening from start to finish. A considerable amount of enthusiasm was in evidence, as Mr. Gordon Smith had, for the third time, secured the Blue Riband of the canine world, the Waterloo Cup, and in addition, Mrs. Gordon Smith had secured the Waterloo Plate, which, as one speaker remarked, looked as though this annual race was being turned into a Smith's or family affair. During the evening a very happy and pleasant function was performed by presenting to Mr. and Mrs. Gordon Smith a handsome silver salver—a copy of very fine antique George III period—as the annual dinner synchronised with the twenty-fifth anniversary of their wedding. Mr. Gordon Smith made a very happy and suitable reply to the compliment. The whole of the staff present demonstrated the very excellent understanding prevailing between the directors and employees. The evening's arrangements were most admirably organised by Mr. J. E. Chorlton, well known to all in aviation circles.

AIR MINISTRY NOTICE TO AIRMEN

Civil Air Maps of Great Britain

1. Sheets 2 and 3 of the Ordnance Survey Ten Mile Map of Great Britain (Special Air Edition) are now on sale, price 5*s.* (paper flat) and 6*s.* (linen-backed folded) per sheet.

The maps, printed in colours, are produced on a scale of ten statute miles to one inch (1 : 633600). Topographical relief is shown by layers in brown, with contour lines. The positions of aerodromes, landing grounds, seaplane stations, air navigation lights, prohibited areas, and danger areas are shown in red.

The approximate areas covered by the sheets are :—

Sheet 2.—S. Scotland, N. England, Midlands, and N. Wales, between Lat. 56° 30′ N., and Lat. 52° 45′ N.

Sheet 3.—Wales, Midlands, and S. England, S. of Lat. 53° 37′ N.

Sheet 1, which covers that portion of Scotland lying N. of Lat. 55° 40′ N., is in course of preparation and will be placed on sale shortly.

2. Sheet 12 of the ¼-inch Ordnance Survey Map of England and Wales (Civil Air Edition) is now on sale, price 2*s.* 6*d.* (paper flat) and 3*s.* 6*d.* (linen-backed folded).

The map, printed in colours, is produced on a scale of ¼-inch to 1 mile (1 : 253440). Topographical relief is shown by layers in brown, with contour lines at 200 feet vertical intervals. The positions of aerodromes, landing grounds, seaplane stations air navigation lights, official air routes, prominent landmarks, ground signs, D/F stations, prohibited areas, danger areas, high W/T masts, etc., are shown in red.

The sheet covers approximately that portion of S.E. England lying S. of Lat. 51° 39′ N., and E. of Long. 0° 50′ W.

Other sheets are in course of preparation and will be placed on sale shortly.

3. Copies of these maps may be obtained through the usual agents or any bookseller, and from Flight Office, 36, Great Queen Street, Kingsway, London, W.C.2.

(No. 23 of 1929.)

AIR MINISTRY NOTICE TO GROUND ENGINEERS

Revised Requirements for Certificates of Airworthiness

1. The attention of all concerned is called to the revised requirements for Certificates of Airworthiness as recently published in the Airworthiness Handbook for Civil Aircraft.

2. It is not the intention of the Air Ministry to apply these revised requirements retrospectively in the case of aircraft which are already in possession of a Certificate of Airworthiness during the currency of that certificate. When, however, the certificate comes up for renewal and it is found that the aircraft does not comply with the revised conditions, a special report on each aircraft will be furnished by the Director of Aeronautical Inspection, and the question of renewal in each case will be considered on its merits. With regard to "subsequent" aircraft, which are the subject of application for original certification (as distinct from renewal of certificate), as from 1st June, 1929, such aircraft will normally be required to conform with the revised requirements in order to qualify for the issue of a Certificate of Airworthiness.

(No. 10 of 1929.)

IN PARLIAMENT

Aeroplanes for Export

The Under-Secretary of State for Foreign Affairs, on April 16, in reply to Mr. Garro-Jones, said: I understand that negotiations have taken place between the Soviet Government and a British aircraft company with a view to the supply to Russia of a considerable number of aeroplanes. No licence is required to export aeroplanes from the United Kingdom. If however, the aeroplanes are fitted with any armament, such as machine guns or machine gun mountings, a licence would be required before that armament could be exported. No application for a licence to export such material to the Soviet Government has been received recently. It is not the policy of His Majesty's Government to impose restrictions upon the export of civil aircraft to foreign countries.

Air Force and Holyhead

Sir R. Thomas, on April 18, asked the Secretary of State for Air whether he has considered the suitability of Holyhead as a marine air port for the Customs clearance of passenger traffic by flying-boats between England and Ireland; if so, what conclusions has he formed; and, if not, will he consider this?

Mr. Penny (Lord of the Treasury), who replied, said the question of making Holyhead a Customs aerodrome for seaplanes has been considered, but it has been thought best to defer any detailed investigation for the present until it can be seen more clearly how air traffic to and from the port is likely to develop and what the practical needs of the traffic will be.

Air Services London-India

Mr. Penny, in reply to Sir R. Thomas, said negotiations for a permanent agreement between Italy and Greece in regard to the choice of an air port in the latter country to serve aircraft plying on the Croydon-India route are proceeding. Pending the settlement of outstanding questions, arrangements have been made for the use of certain airports during a period of three months.

The Lynx-Fokker

The first of the Armstrong-Siddeley "Lynx" engined Fokkers has just flown from the Fokker works at Amsterdam to Zurich for use on the new Ad Astra Air service.

Rescue Expeditions Use Castrol

It is interesting to note that all the relief aeroplanes which combed the desolate regions of North-west Australia in search of the *Southern Cross* and its occupants used Wakefield Castrol motor oil. Supplies of Castrol were transported by air to emergency depots as far as 2,000 miles from the base stores—and all without a hitch or even an hour delay.

National Flying Services, Ltd.

National Flying Services, Ltd., which has a share capital of £350,000 in 2*s.* shares, has made an issue of 2,000,000 of those ordinary shares at par, and of £150,000 of 7 per cent. first mortgage debenture stock at 97½. The lists for the issue closed for London at noon on April 23, and for the country on April 24.

NEW COMPANIES REGISTERED

NORTHERN AIRLINES (MANCHESTER), LTD.—Capital £500, in £1 shares. Objects: To carry on the business of an aerial transport company, etc. The directors &c., are the same as those in Northern Air Transport, Ltd.

NORTHAMPTONSHIRE AERO CLUB, LTD., 19, Market Square, Northampton.—Capital £2,000, in £1 shares. Objects: Under agreement with W. Harris and J. T. Jeyes, to acquire all or any part of the assets and liabilities of the present unincorporated body known as "The Northamptonshire Aero Club"; to establish, maintain and conduct a light aeroplane club, etc. Permanent directors: W. Harris (managing director), "Harden," Gypsy Lane, Northampton; F. Harrison, "Upton Lawn," near Northampton; H. Shale, "Romany," Weedon Road, Northampton; E. J. Addis, 51, Birchfield Road, Northampton; A. J. Linnell, "Wilbye House," Kettering; J. T. P. Jeyes, "Holly Lodge," Broughton, Northants; T. Illingworth, Sheep Street, Wellingborough, Northants. Secretary: P. Hayward.

NATIONAL FLYING SERVICES, LTD., Grand Buildings, Trafalgar Square, S.W.—Capital £350,000, in 2*s.* shares. Acquiring the freehold property known as the Hanworth Park Estate and any lands suitable for aerodromes, flying clubs, to equip the same for all purposes connected with flying or flying clubs, running of air services, to enter into agreements with the Secretary of State for Air, or any other Government authority or department, to establish and carry on flying clubs and associations, etc., and to adopt an agreement with Feltham Garden Suburb, Ltd. First directors: Capt. the Right Hon. F. E. Guest, D.S.O., M.P., 7, Aldford Street, W.1; J. G. Peel, Peover Hall, Knutsford, Chester; the Hon. Dame Mary Bailey, 38, Bryanston Square, W.1; Col. the Master of Sempill, A.F.C., 12, Gardner Mansions, Church Row, Hampstead; Sir Alan J. Cobham, K.B.E., A.F.C., 22, Frognal Lane, Hampstead, N.W.3; A. G. Hemsley, 1, Melina Place, St. John's Wood, N.W.8; W. S. Stephenson, M.C., D.F.C., F.R.S.A., 143, Harley Street, W.1; Lieut.-Col. I. A. Edwards, C.M.G., Downe Hall, Downe, Kent; G. E. F. Boyes, 39, Cholmley Gardens, N.W.6.

THE TRAVEL ASSOCIATION OF GREAT BRITAIN AND IRELAND.—A company limited by guarantee, without share capital, with an unlimited number of members, each liable for £1 in the event of winding up. The word "limited" is omitted from the title by licence of the Board of Trade. The objects are (*a*) to increase the number of visitors from overseas to Great Britain and Ireland, (*b*) to stimulate the demand for British goods and services and promote international understanding, etc. First members of the Executive Committee are Earl of Derby, K.G., Lord Ashfield, P.C., Alderman F. Britain, Sir Harry Brittain, M.P., F. H. Cook, D. H. Hacking, M.P., G. R. Hall-Caine, M.P., S. J. Lister, W. Payne, Sir Felix J. C. Pole, Lord Riddell, H. Gordon Selfridge, Sir Francis W. Towle, Sir Gilbert C. Vyle.

PUBLICATIONS RECEIVED

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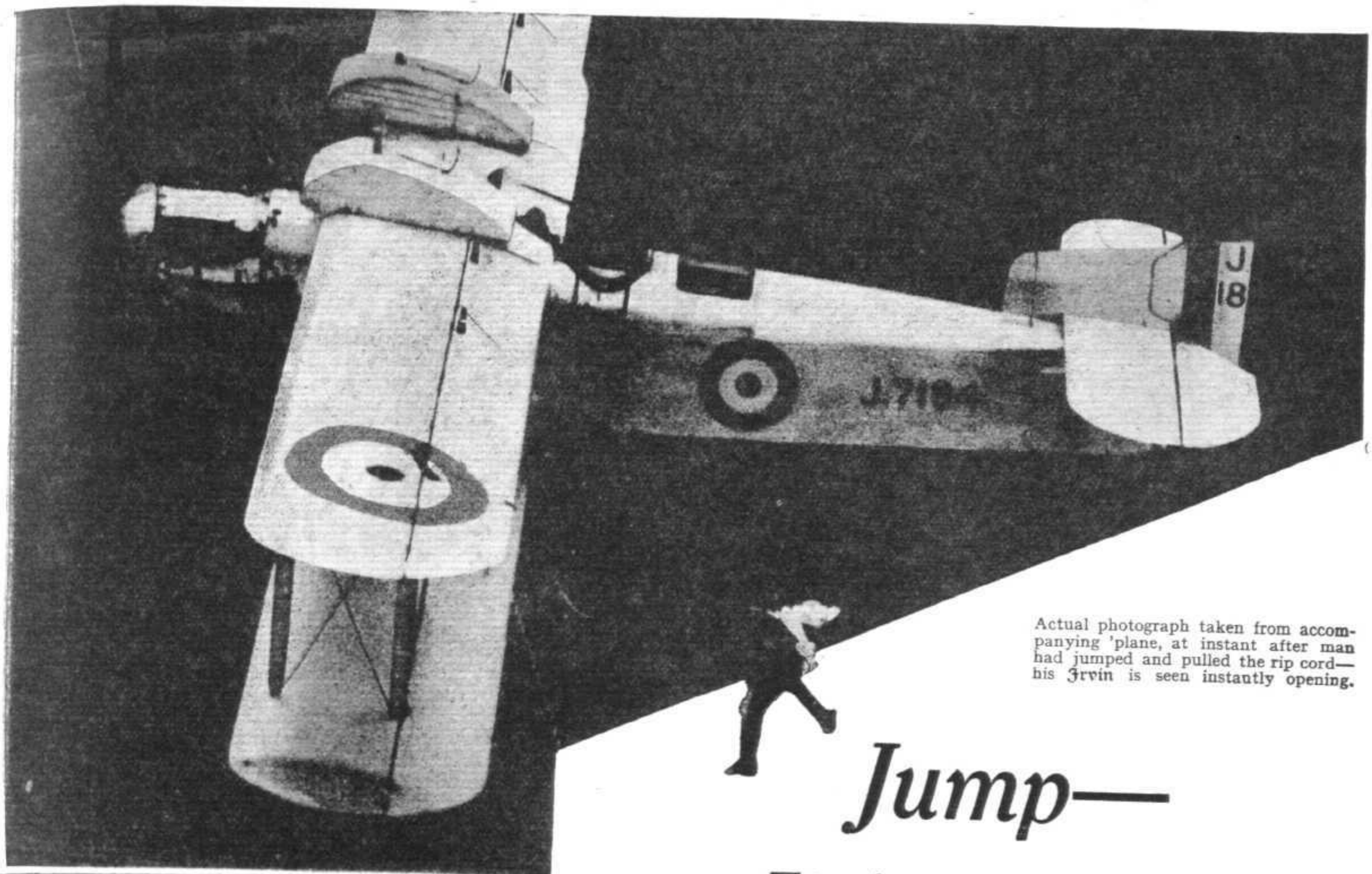

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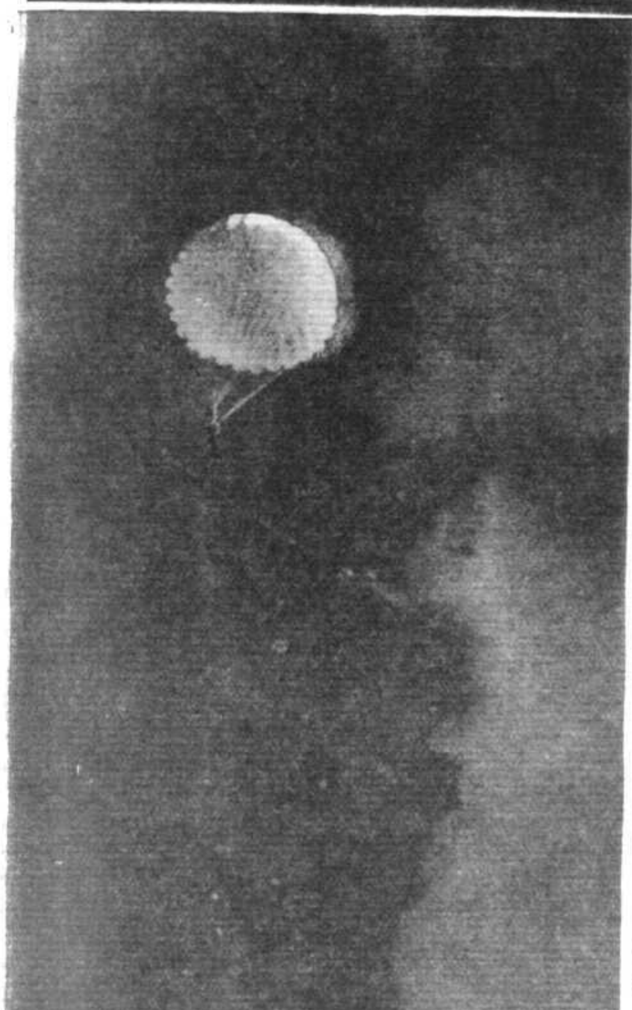

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